UNE, 1957

RUBBER WORLD

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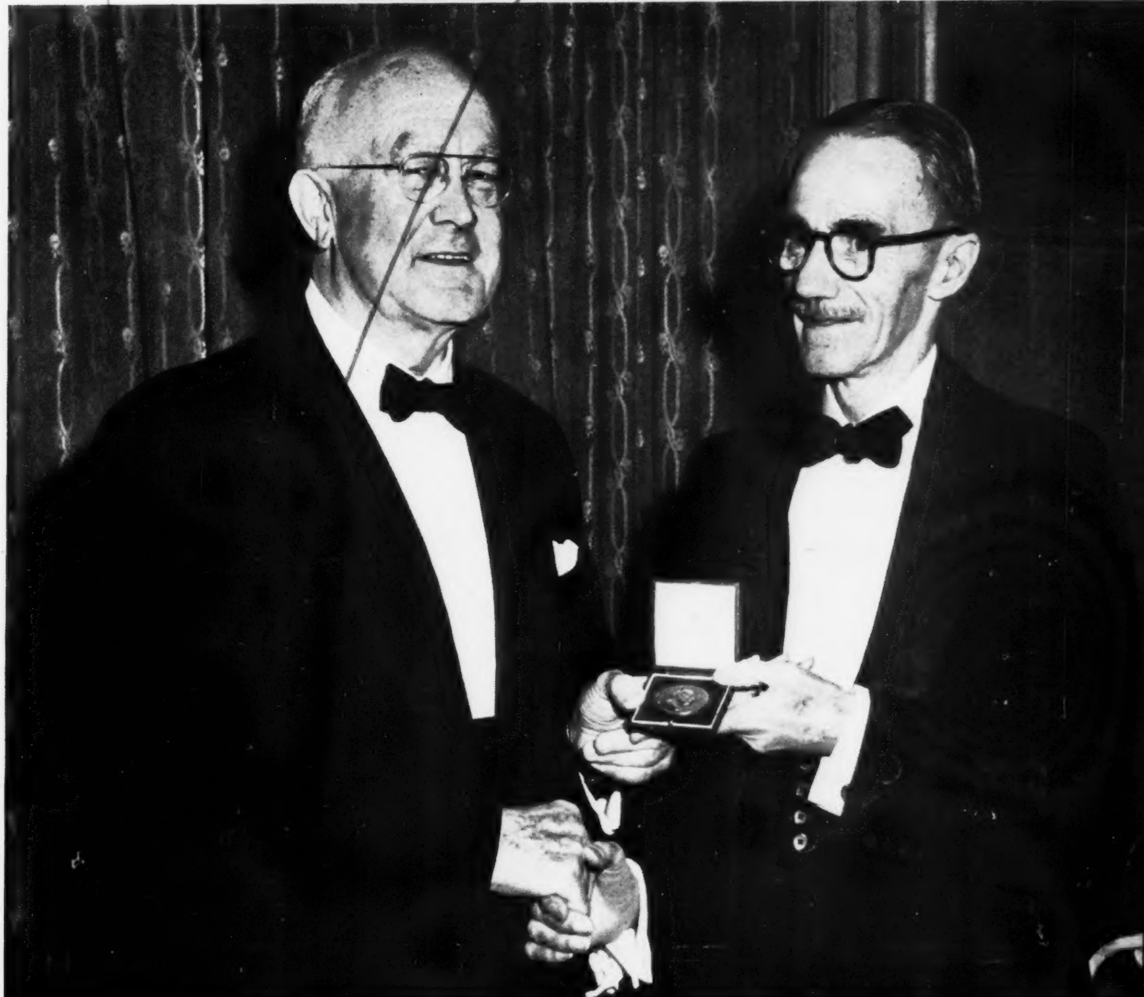

Colwyn Medal Presented at Montreal Conference (page 393)

A BILL BROTHERS PUBLICATION

HIGH-TEMPERATURE AIRCRAFT TIRES

By L. J. Kitchen, page 379

RUBBER WORLD, June, 1957, Vol. 136, No. 3. Published monthly by BILL BROTHERS PUBLISHING CORP., Office of Publication, 1309 Noble Street, Philadelphia, Pa., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription United States $5.00 per year; Canada $6.00. All other countries $7.00 Single Copies 50¢. Address Mail to N. Y. Office.

RUBBER WORLD

JUNE, 1957

VOLUME 136, NUMBER 3

FEATURES

DEPARTMENTS

Cover Photo: W. B. Wiegand, Columbian Carbon Co., *left,* receives Colywn Medal of the Institution of the Rubber Industry, London, England, from G. Stafford Whitby, University of Akron, at the First Joint Conference of the Rubber Divisions, ACS and CIC, Montreal, May 16.

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The opinions expressed by our contributors do not necessarily reflect those of our editors.

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LET ALL THE PHILBLACKS WORK FOR YOU!

A — **Philblack A, Fast Extrusion Furnace Black.** Excellent tubing, molding, calendering, finish! Mixes easily. Disperses heat. Non-staining.

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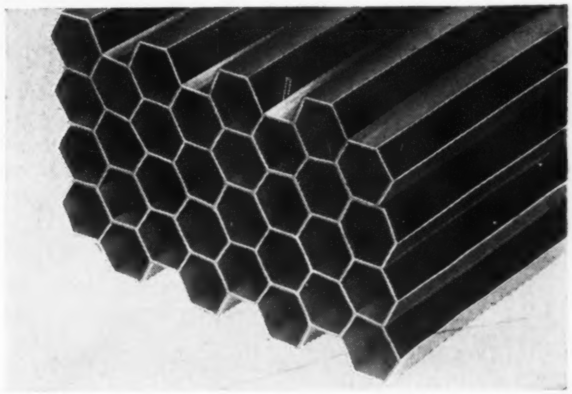
E — **Philblack E, Super Abrasion Furnace Black.** Toughest black yet! Extreme resistance to abrasion.

PHILLIPS CHEMICAL COMPANY, Rubber Chemicals Division, 318 Water St., Akron 8, Ohio. **District Offices:** Chicago, Providence and Trenton. **West Coast:** Harwick Standard Chemical Company, Los Angeles, California. Warehouse stocks at above points and Toronto, Canada. **Export Sales:** 80 Broadway, New York 5, N. Y.

*A trademark

News about

B.F.Goodrich Chemical *raw materials*



One of the new applications of Hycar American Rubber is this honeycomb which is multiple extruded and used as a spring core for freight car journal box lubricators. A unique rubber product, it has exceptional radial spring, axial stiffness and stability of shape and dimension. It withstands temperature extremes, oil immersion and abrasion.

*blister resistant Hycar

*new compounds meet industrial specs

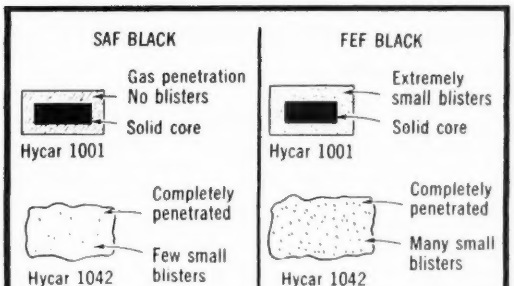
Blister resistant Hycar for high pressure gas service. A new, extremely strong and blister resistant Hycar compound — 1001/SAF — has been developed specifically for making sleeves and diaphragms used in high pressure regulators for the oil and gas industry. Ordinary rubbers proved unsatisfactory because they did not have high oil resistance combined with physical strength to reduce oil and gas penetration; and the ability to withstand internal pressures from entrapped gases after flow pressures up to 3000 psi were removed. This pressure removal often caused severe swelling or complete rupture of parts made from ordinary rubber. Following tests on various Hycar compounds, these conclusions were reached:

(1) High acrylonitrile Hycar polymers perform best.

(2) Loading with fine particle size blacks give highest blister resistance. SAF black provides the best results.

(3) Plasticizers increase blistering. Extractable types are especially bad. Small amounts of non-extractable plasticizer can be used as a processing aid.

(4) The curing system is not important as long as a tight cure is obtained.



Cross sections of several polymers were made after one week's exposure to 100 psi carbon dioxide and 600 psi ethylene. These sections clearly show the superior blister resistance of high acrylonitrile Hycar 1001 and the better performance achieved through SAF Black Loading. Base recipe for this test: Hycar polymers 100.0; Zinc oxide 5.0; Black loading 40.0; TMTD 3.5; Stearic Acid 1.0.

NEW HYCAR COMPOUNDS FOR INDUSTRIAL SPECIFICATIONS

Bendix-Westinghouse Spec 1036-M . . . requiring very low volume change after immersion in ASTM No. 1 and No. 3 oils and satisfactory performance at −40°F. Primary uses: valves and valve seats. *Hycar 1042 compound.*

Military Spec MIL-G-1086A . . . requiring resistance to aviation gasoline, water and asphalt. For gaskets on bolted steel storage tanks. *Hycar 1042 compounds.*

Allison Proposed Spec 22619 . . . requiring a 90±5 Durometer A compound with excellent oil resistance at high temperatures. Two Hycar 1042 compounds meet the spec.

Automotive Spec No. 69 . . . requiring a 70±5 Durometer A compound, good oil resistance and ability to withstand temperature extremes. Applications: lip-type seals and other automotive seals. A Hycar 1042 compound has narrow volume change limits after aging in ASTM No. 1 oil at 300°F; and −15°F low temperature brittleness.

For further information on Hycar nitrile rubber, write Dept. HN-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

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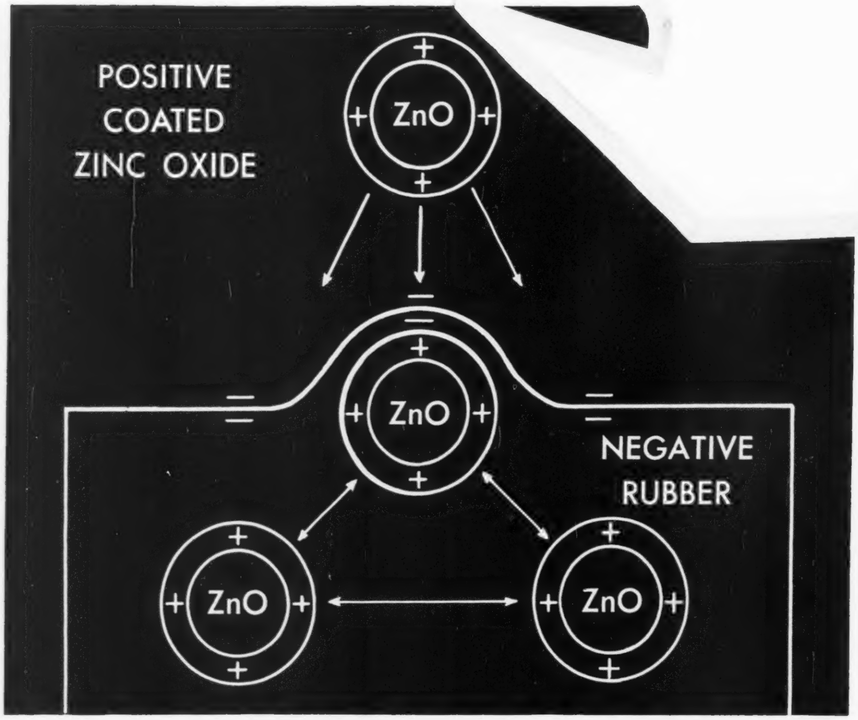
Coated ST. JOE Zinc Oxide provides better rubber processing



ST. JOSEPH LEAD COMPANY
ST. JOE ZINC OXIDE
JOSEPHTOWN, PA.

Technically speaking the monomolecular film of hydrophobic high molecular weight organic ester in St. Joe's *coated* zinc oxide has a more positive charge than that of rubber. Rubber has a greater affinity for coated oxide than uncoated pigment. Practically speaking this property results in faster dispersion and uniform incorporation into the mix.

Added values include:

greater moisture resistance, lower Mooney plasticity, lower permissible mixing temperature, increased mixing capacity, lower power consumption and lower power peak.

If you are not now using St. Joe Coated Zinc Oxide, why not order enough to make a good pilot plant test? Or better yet production test? This is the best way to prove to yourself that this grade of oxide would be best for your production and end-product.

ST. JOSEPH LEAD COMPANY **250 Park Ave., New York 17**
Plant and Laboratory,
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12" Stroke
2—5" Openings
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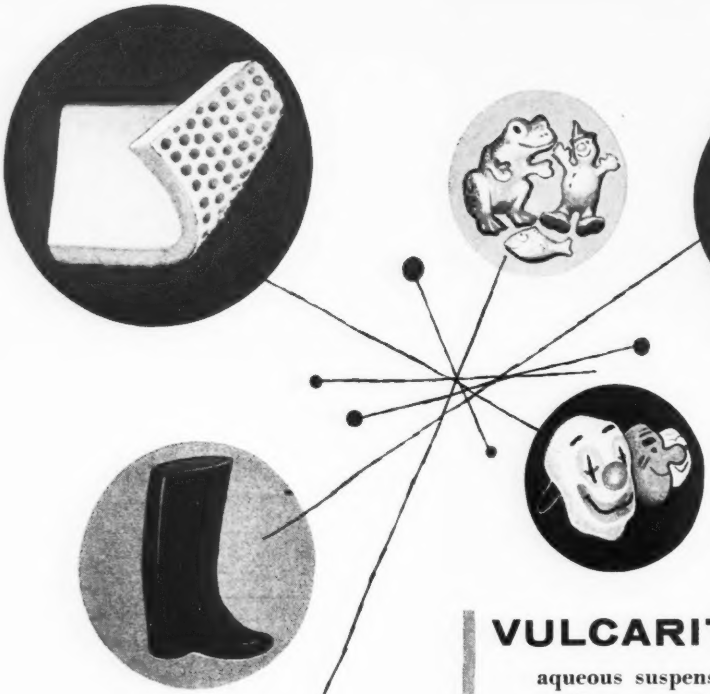

ALCO PRODUCTS for the Rubber Industry

VULCARITE®

aqueous suspensions of pigments, antioxidants, softeners, antifoam materials, activators and accelerators for easy use with natural and synthetic rubber latices. There are 23 standard Vulcarite suspensions. We will gladly custom-tailor a VULCARITE to your specifications.

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Have you investigated our VULCANOL® latex based coatings and adhesives, or VULCAFOAM®, complete foam formulations?

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GENERAL OFFICE and MANUFACTURING PLANTS TRENTON AVENUE and WILLIAM STREET, PHILADELPHIA 34, PA. GARFIELD 5-0621

Photo courtesy Hofran Incorporated, Tampa, Fla.

Now—"Iron Mike" has met his master!

It's tough to make the starting team in the big leagues. But for a baseball, it's even tougher to qualify for batting practice. For here there's little letup in the pounding, the scuffing or the skinning. Particularly when "Iron Mike," the pitching machine, does the serving up.

A standout performer in this job – and in playgrounds, sand lots and batting ranges across the country–is an unusually durable ball with a molded-on, rubberized cord cover. This cover fully resists impact, abrasion and moisture, including repeated washing. As a result the ball retains its size, shape, weight and "grippability" much longer than its higher priced counterparts.

Much of the success of this ball lies in the use of three Goodyear materials in the cover compound. PLIOFLEX, the light-colored, oil-extended rubber, lowers both weight and cost without loss of desirable qualities. PLIOLITE S-6B – the high styrene, rubber reinforcing resin – adds toughness and a leatherlike feel. And WING-STAY S–a nonstaining antioxidant–protects the original whiteness and physical properties against age and sunlight.

Mastering "Iron Mike" is just one example of how properly compounded PLIOFLEX rubber can answer many product problems. If you would like more information on how PLIOFLEX or PLIOLITE S-6B or WING-STAY S can help your products, just write to:

Goodyear, Chemical Division, Dept. F-9418, Akron 16, Ohio.

Chemigum, Plioflex, Pliolite, Plio-Tuf, Pliovic, Wing-Stay–T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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RUBBER &
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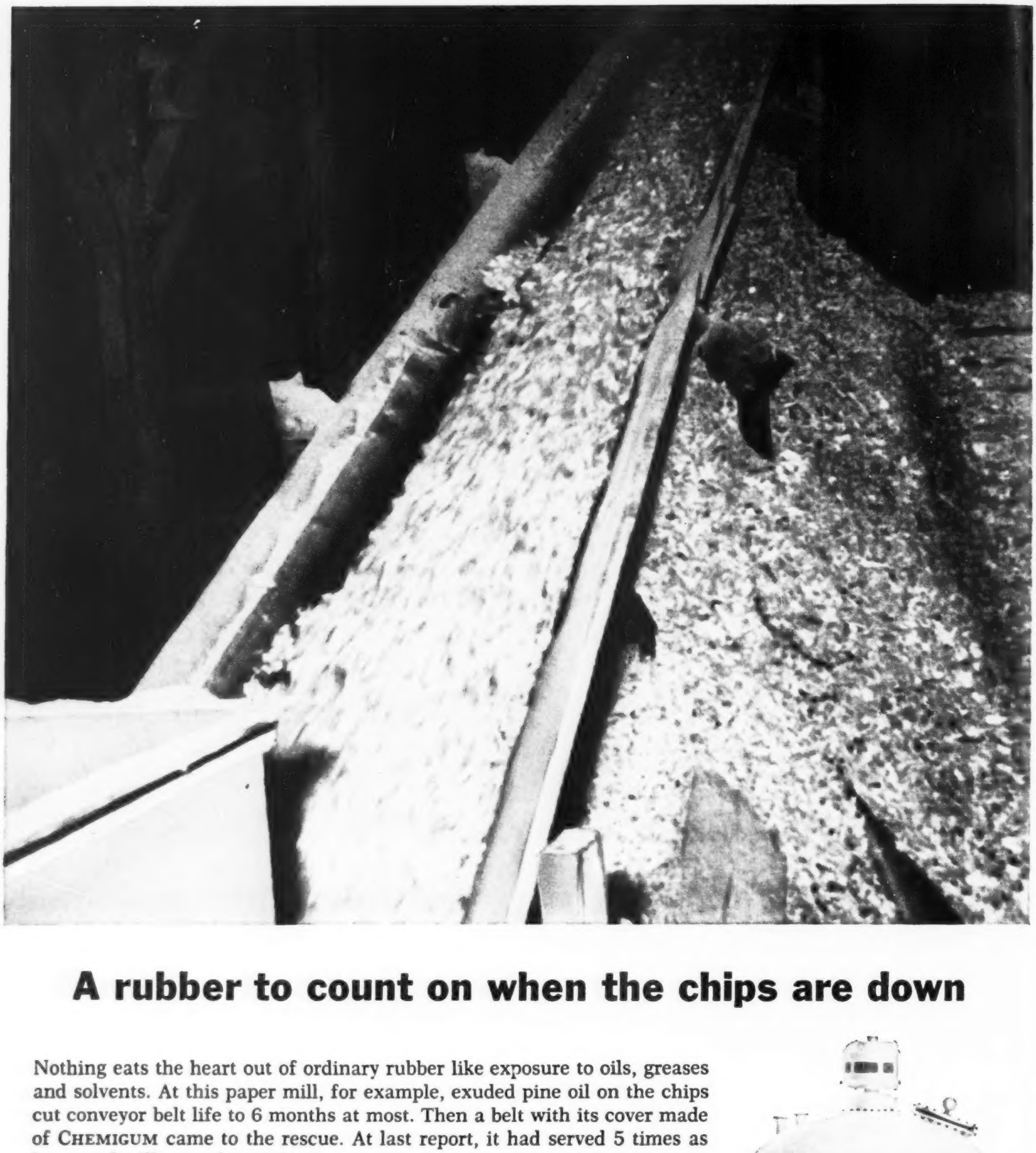
CHEMIGUM • PLIOFLEX • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS

High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries



A rubber to count on when the chips are down

Nothing eats the heart out of ordinary rubber like exposure to oils, greases and solvents. At this paper mill, for example, exuded pine oil on the chips cut conveyor belt life to 6 months at most. Then a belt with its cover made of CHEMIGUM came to the rescue. At last report, it had served 5 times as long–and still no end in sight.

You see, CHEMIGUM is a nitrile rubber. It's especially resistant to all types of grease and oils – even at high temperatures. It's easily processed into a variety of rubber products–from conveyor belts to hose to printing press rolls to tiny oil seals. In fact, there's nothing quite like it for long, satisfactory service in operations involving petroleum products.

Why not try CHEMIGUM, then, for solving your tough rubber problems. You can quickly and easily obtain full details, samples and the latest *Tech Book Bulletins* by writing Goodyear, Chemical Division, Akron 16, Ohio.

CHEMICAL
GOODYEAR
DIVISION

Rubber
& Rubber Chemicals
Department

Chemigum, Plioflex, Pliolite, Plio-Tuf, Pliovic –T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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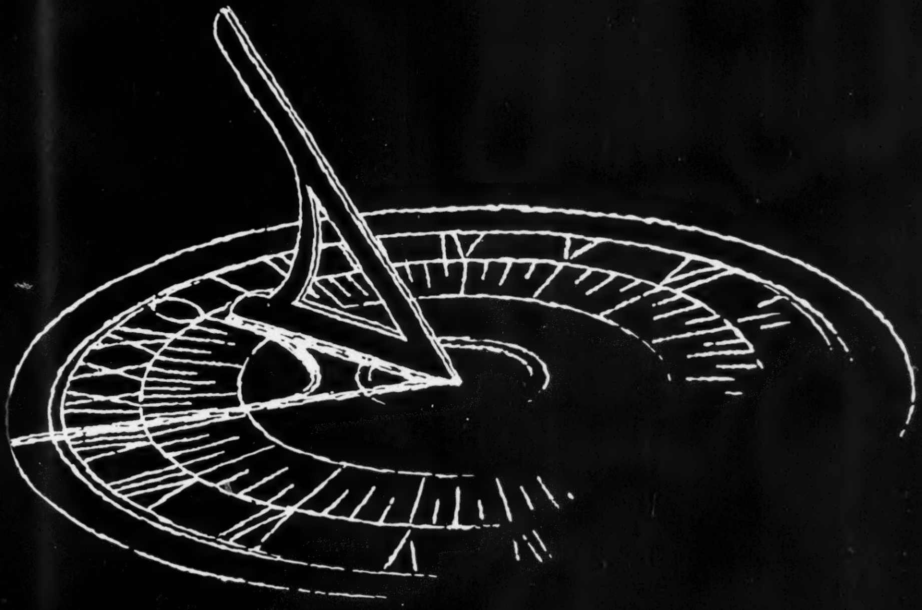
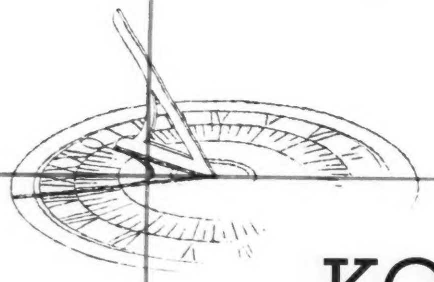
High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

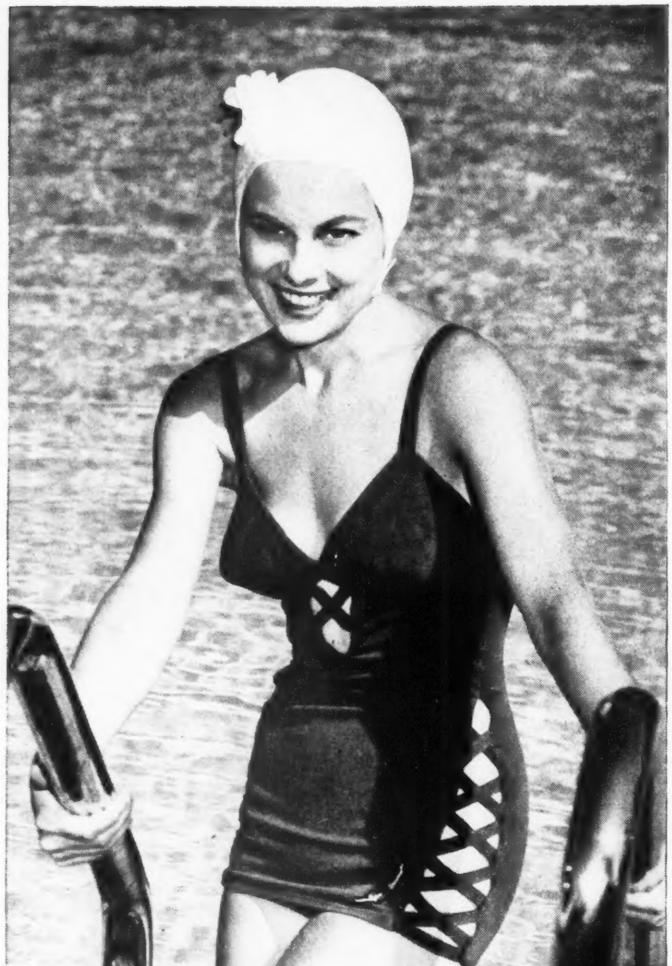
RLD

1





DI-CUP KEEPS WHITE STOCK WHITER



First introduced commercially last year. Hercules Di-cup (dicumyl peroxide) has already become well established as a curing agent that improves whiteness and color retention of white stock formulations.

Because Di-cup does not contain sulfur and will not discolor, white stock is whiter from the very beginning. And Di-cup's outstanding color retention keeps the finished product white longer despite exposure to the sun.

A stable peroxide of low volatility, Di-cup gives good retention of elongation, modulus, and tear strength on aging. It also provides low compression set in vulcanizates of natural rubber and most synthetic elastomers.

For more information on this versatile and economical curing agent, send for new data sheet.

DI-CUP®

Oxychemicals Division • Naval Stores Department

HERCULES POWDER COMPANY

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914 Market St., Wilmington 99, Del.

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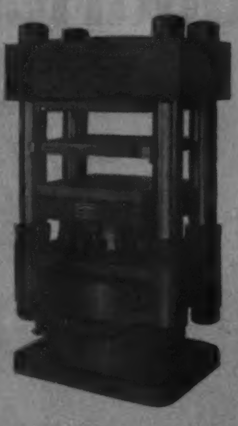
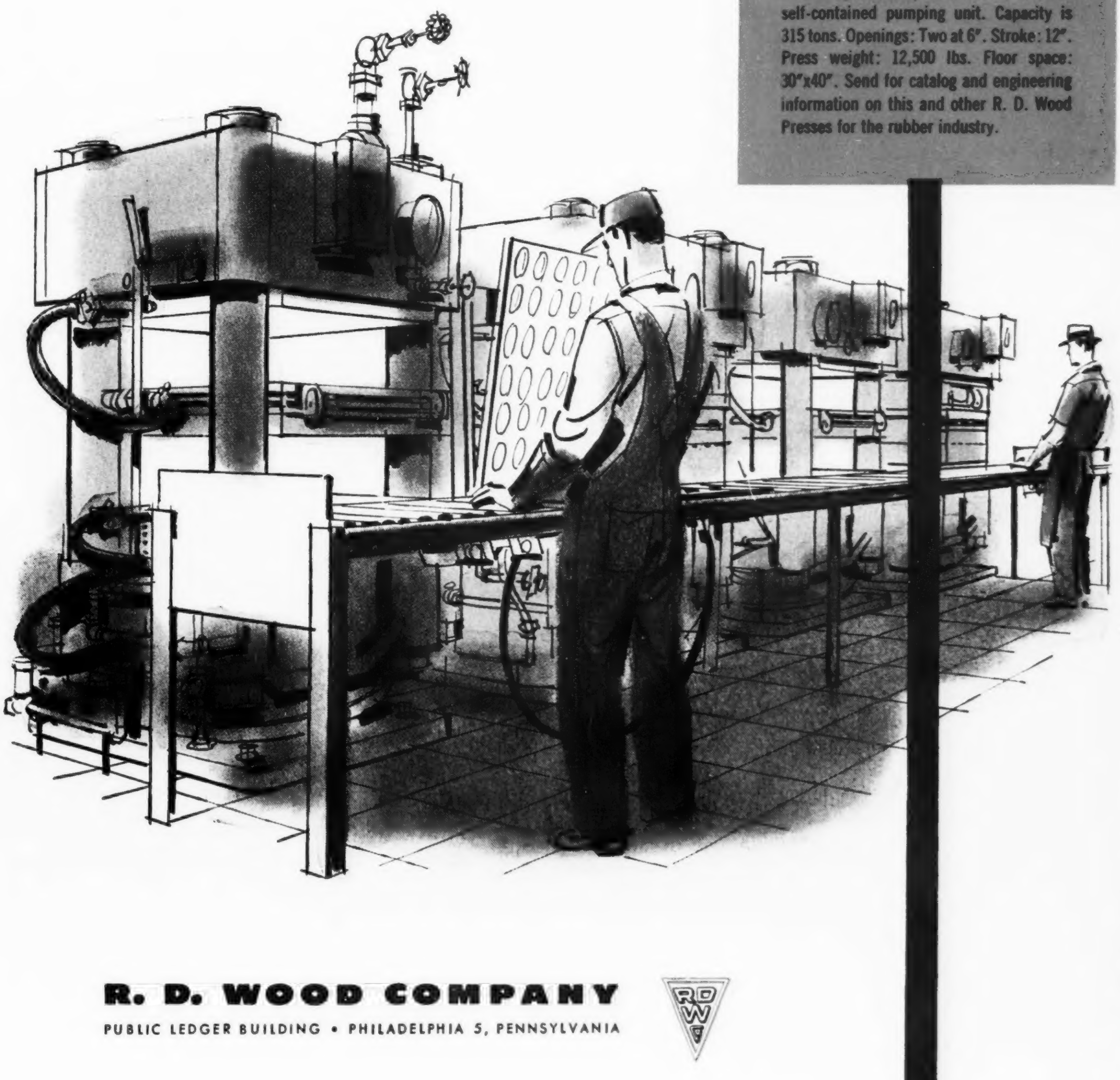
Put a Wood Press to work and get the money-saving advantages of smooth, dependable performance . . . long operation with low maintenance.

Reason: every Wood Press is the product of sound design, carefully selected materials, conscientious craftsmanship. This is why Wood Presses are known throughout industry for their trouble-free operation and fast, economical production. R. D. Wood has many standard press designs for such jobs as molding, curing, laminating, polishing and processing—and engineers others for special work. Write for our catalog and engineering information. No obligation, of course.

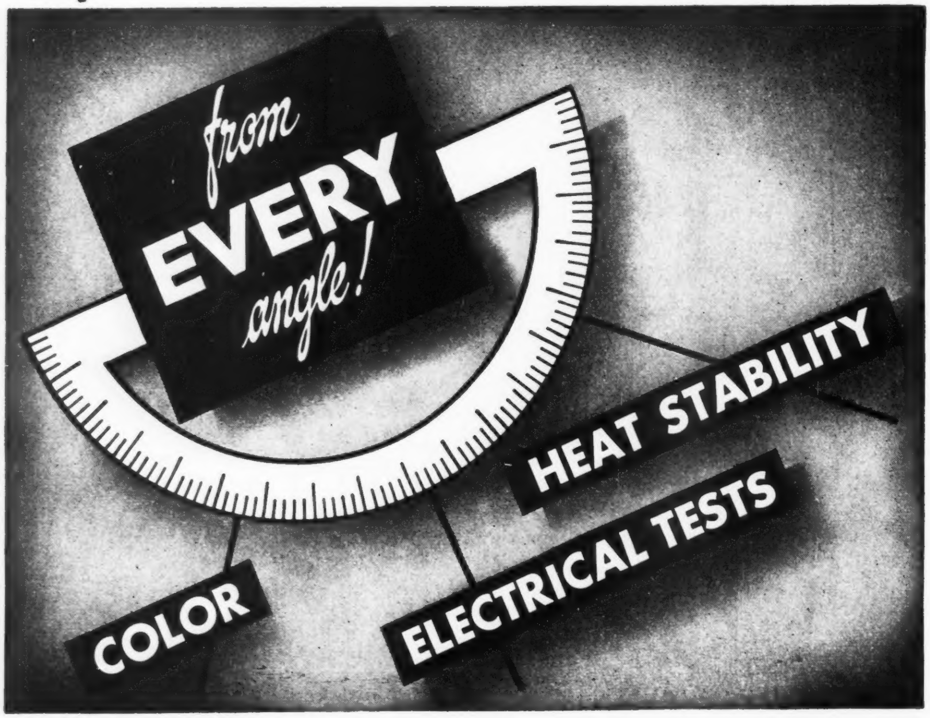


R. D. Wood High-accuracy 24"x24", 2-opening Press for molding rubber products. Can be furnished for operation from a central hydraulic system or with its own self-contained pumping unit. Capacity is 315 tons. Openings: Two at 6". Stroke: 12". Press weight: 12,500 lbs. Floor space: 30"x40". Send for catalog and engineering information on this and other R. D. Wood Presses for the rubber industry.



R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA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HEAT STABILITY
ELECTRICAL TESTS
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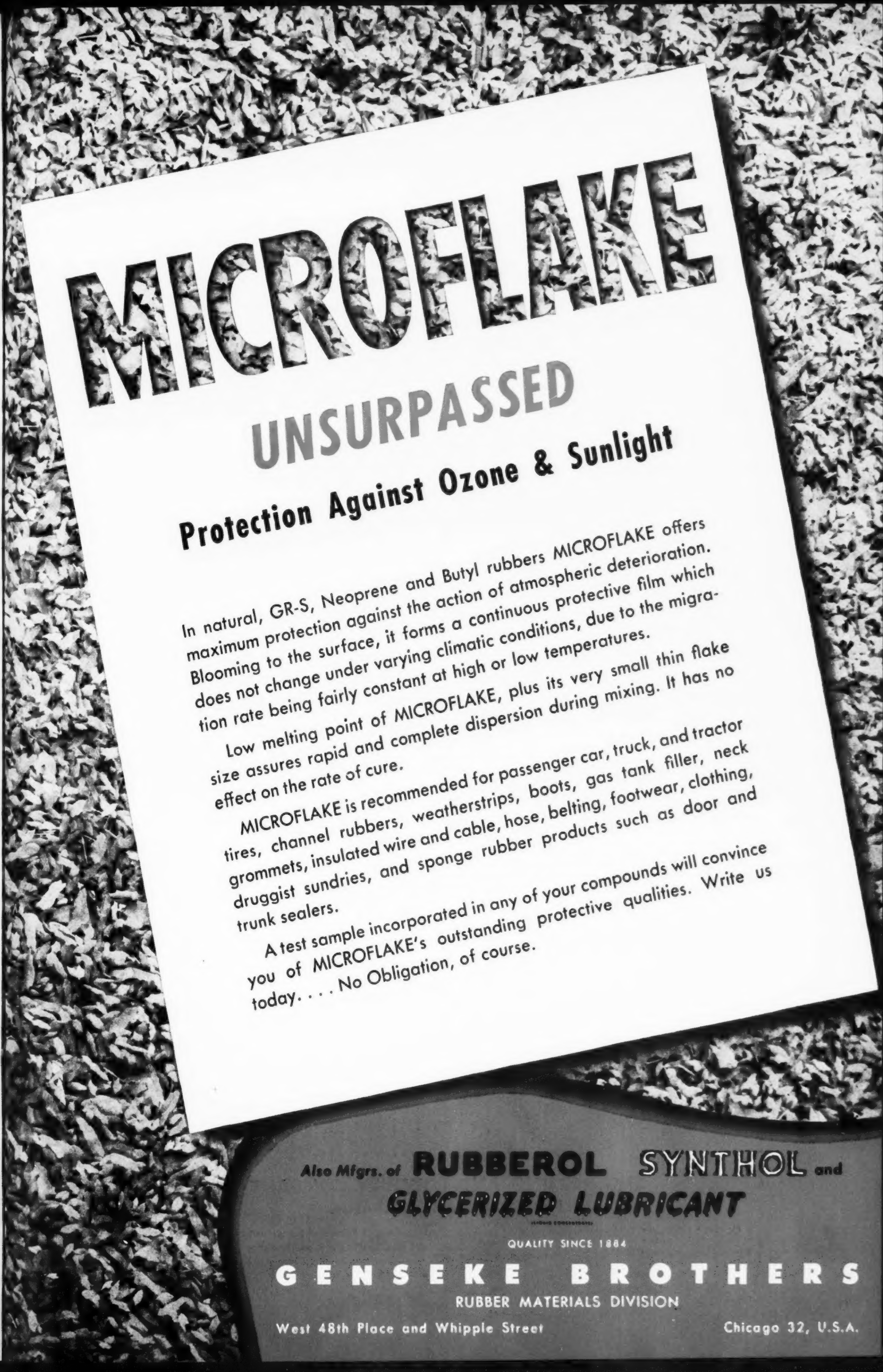
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MICROFLAKE is recommended for passenger car, truck, and tractor tires, channel rubbers, weatherstrips, boots, gas tank filler, neck grommets, insulated wire and cable, hose, belting, footwear, clothing, druggist sundries, and sponge rubber products such as door and trunk sealers.
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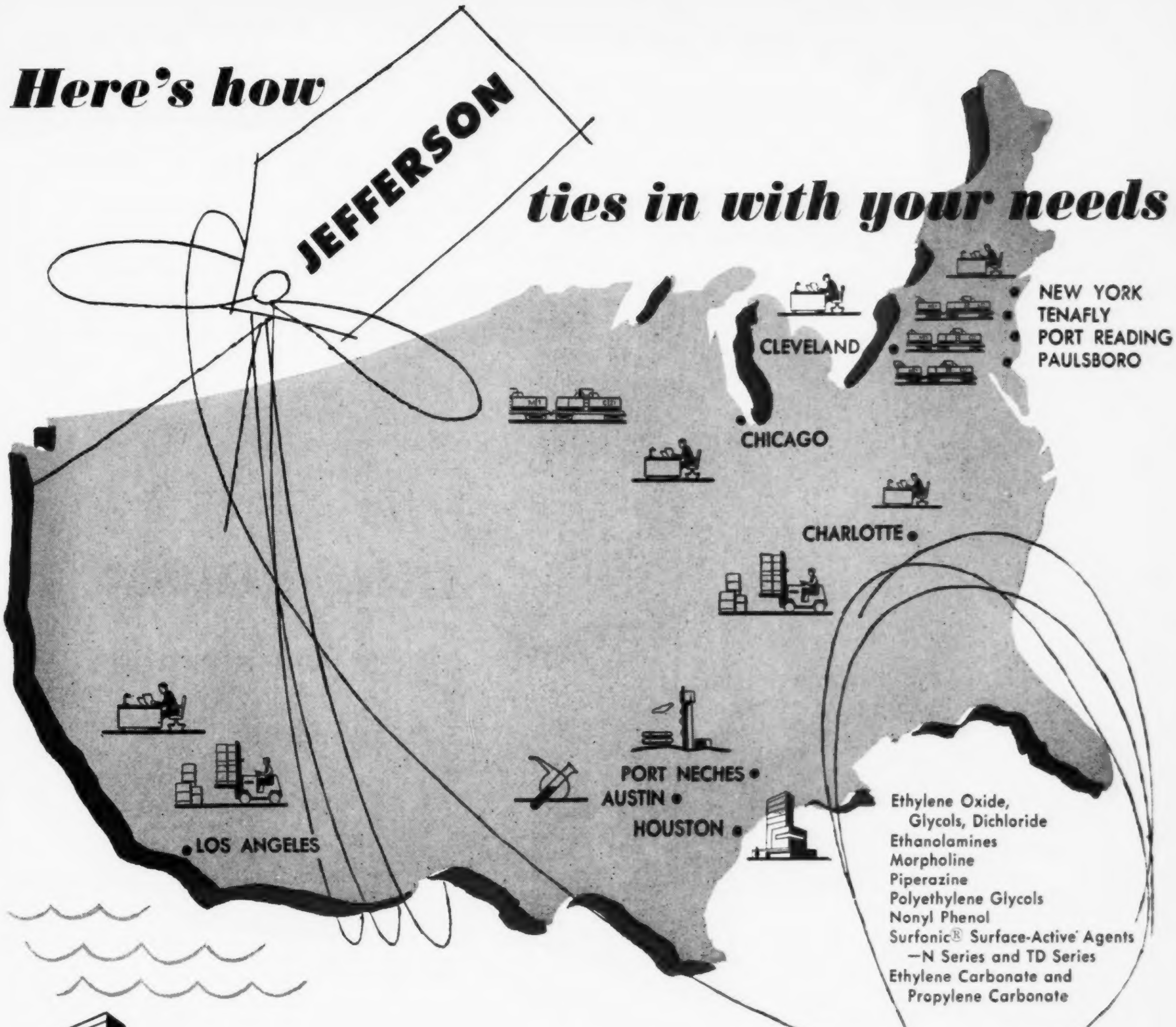

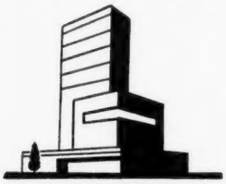

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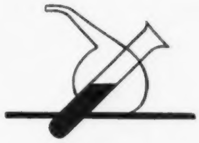

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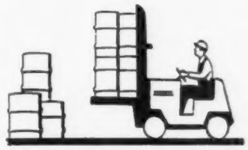

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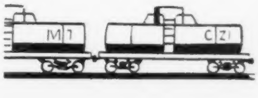

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LATEX FOAM?

In the West—make it from SHELL SYNTHETIC RUBBER

If you make or contemplate making foam rubber products, you will be glad to know that a new unit to produce cold high solids butadiene-styrene latices has just come on stream at Torrance.

Shell Chemical's newest Latex S-2105 has excellent uniformity, color and aging properties. It is ideal for latex foam, carpet backing adhesives and other applications where a high-solids latex is required.

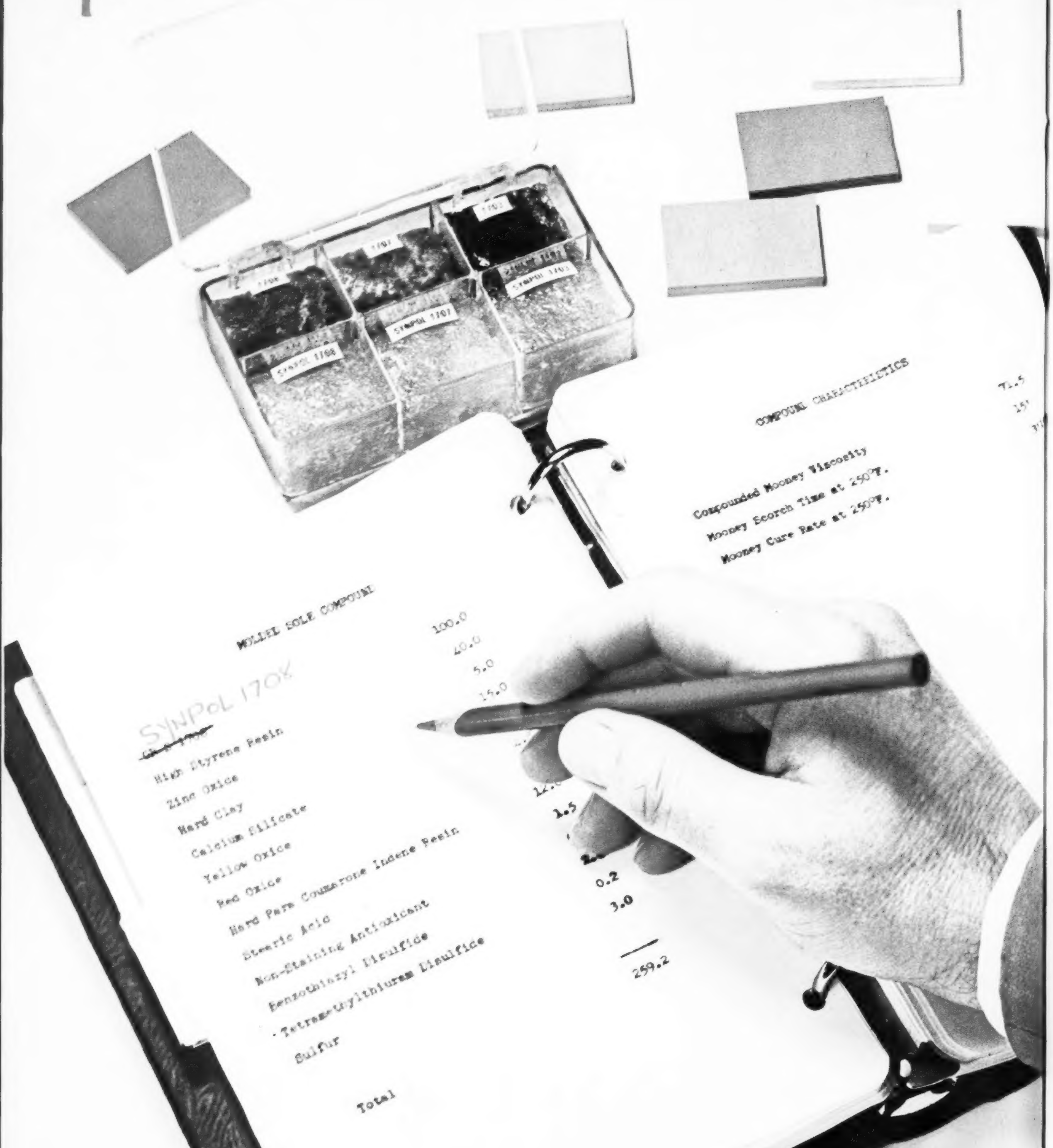
In addition to latices, a full line of butadiene-styrene solid type rubber is available to fulfill the requirements of Western manufacturers, large and small.

Convenient location and diversity of product make Torrance your logical Western source for synthetic rubber. Important, too—Shell's Technical Service Laboratory is ready to help you find practical solutions for troublesome technical problems.

Think of Torrance, California, whenever you need synthetic rubber in solid types or liquid latices. Our phone number in Los Angeles is Faculty 1-2340.

SHELL CHEMICAL CORPORATION
Synthetic Rubber Sales Division
P. O. Box 216, Torrance, California

Now! LIGHT-COLORED RUBBERS w



These light-colored 1703, 1707 and 1708 SYNPOLS, made with the new **TEXUS** non-volatile pale oil, offer unprecedented opportunities for the economical manufacture of many *new* light-stable, white, bright and pastel-colored rubber products, such as shoe soles, floor tile, toys, code wire and a variety of mechanical goods.

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SY
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with no need to change your compounds

New improved 1703, 1707 and 1708 SYNPOLS answer the need for fast, high-temperature processing rubbers in light-colored products

TEXUS offers light-colored 1703, 1707 and 1708 SYNPOLS which are *100% interchangeable* . . . number for number . . . with the dark-colored oil rubbers of the same types. These new improved SYNPOLS can be substituted in the most critical formulas, with confidence that their volatility, curing characteristics and physicals of the vulcanizates will not differ from the same grades of dark-colored rubbers, which you may now be using.

The rubber compounder need change no more than the polymer name in his formula book . . . except, perhaps, for a change in pigment to take advantage of the white and pastel colors these new improved SYNPOLS make possible.

NEW DEVELOPMENT

These light-colored, oil-extended polymers are made possible by the development of a new, non-volatile pale naphthenic oil, used exclusively in TEXUS SYNPOLS. For the first time, the advantages of light-color and fast, high-temperature processing have been combined! And the light color is retained in the vulcanizates even after extreme and prolonged exposure to sunlight and heat.

The complete interchangeability of these new TEXUS SYNPOLS offers you two important advantages.

Eliminates need for extensive formula testing or compound adjustment. Extensive factory tests and their current use in product manufacture by present TEXUS customers minimize or eliminate your need of testing when adopting these new light-colored, oil-extended polymers.

Eliminates need for costly double inventory. Use of the new improved SYNPOLS gives you added flexibility of operation because they can be easily used for a wider variety of products . . . some which may not require light color as well as those in which light color *and* fast, high-temperature processing are important.

Find out how your product line can benefit from the new SYNPOLS by calling or writing your TEXUS representative today.

THE CASE FOR SYNPOLS

This convincing comparison case shows the new 1703, 1707 and 1708 SYNPOLS side by side with dark rubbers of the same numbers. Your TEXUS representative would like to show it to you and to give you complete information on the entire line of SYNPOLS.

TEXUS

Sales Agent:
Naugatuck Chemical
Naugatuck, Conn.

Plants and General Offices:
Texas-U. S. Chemical Co.
Port Neches, Texas

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260 Madison Ave., New York 16, N. Y.

WIRE SPECIALIZATION *for compatibility with rubber*

Never hesitate to contact National-Standard for technical help on meeting your wire requirements. As you may already realize, no other company has devoted so many years, or so much concentrated research and development, to the teaming of wire with rubber!

This specialized experience can work to your advantage . . . in determining exactly the right wire, cord, braid or tape . . . in helping you work out details of application, fabrication, wire size, strength, finish, adhesion and the many other variables.

So please remember, National-Standard service is always at *your* service.

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DIVISIONS: NATIONAL-STANDARD, Niles, Mich.; *tire wire, stainless, music spring and plated wires* • WORCESTER WIRE WORKS, Worcester, Mass.; *music spring, stainless and plated wires, high and low carbon specialties*

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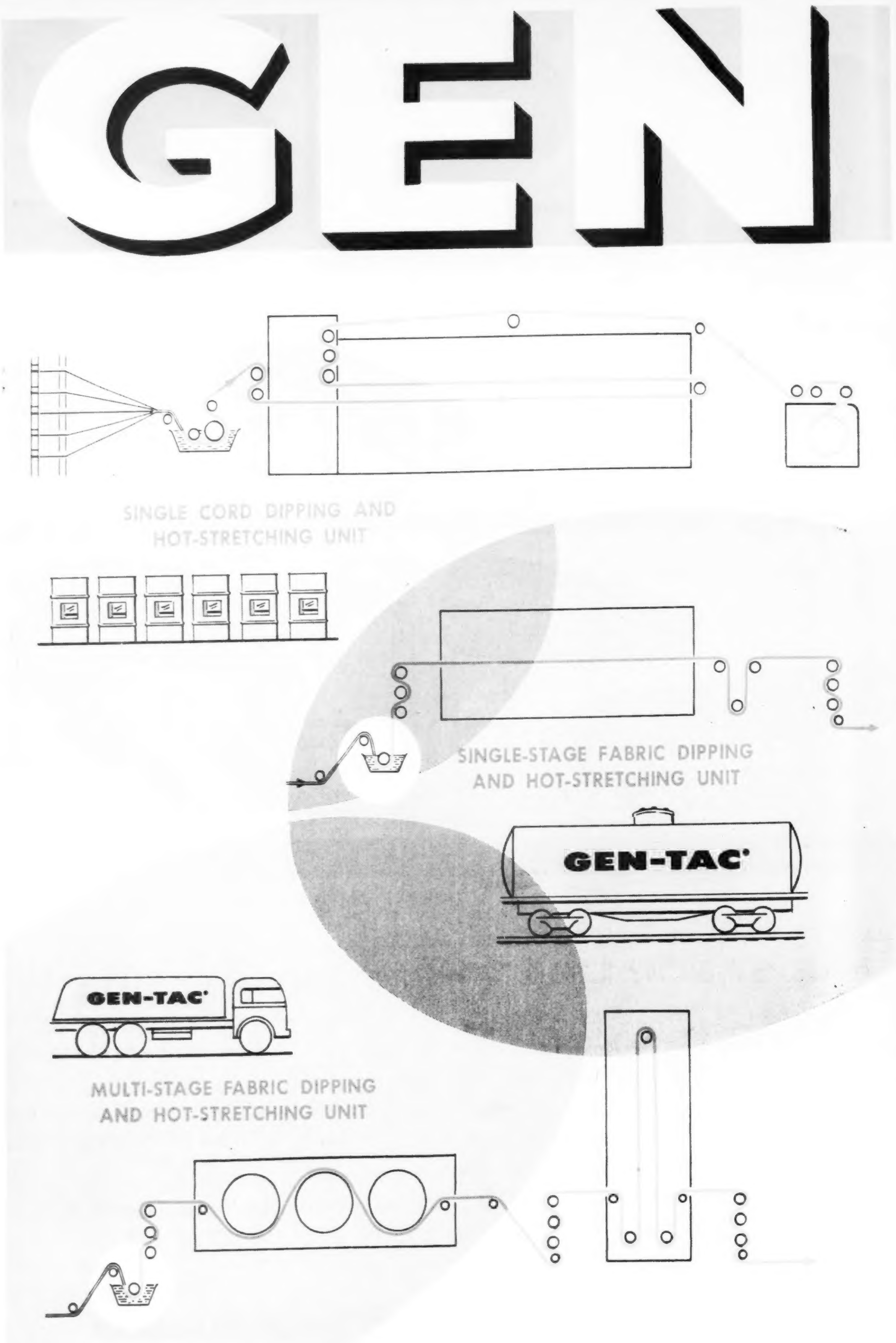
GEN
SINGLE CORD DIPPING AND HOT-STRETCHING UNIT
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Four good answers spell better service . . . bigger profits!

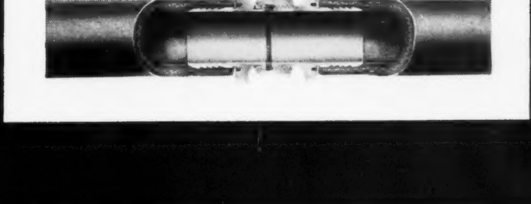
A PERMANENTLY-ATTACHED COUPLINGS COST LESS. And because modern hose is so good . . . lasts so long . . . re-attachable couplings need replacement at about the same time hose does.

A CONTINUING ECONOMY WITH PERMANENTLY-ATTACHED COUPLINGS. Hidden expenses—time, paper work, packing, shipping, etc.—involved in reconditioning of re-attachable couplings eliminated.

A MACHINE-ATTACHMENT ASSURES A MORE PERFECT FIT. Permanently-attached couplings are machine-fitted by experts. You get a permanently fitted coupling every time.

A LEAK-PROOF WITH FULL-FLOW DIAMETER INSIDE. Scovill permanently-attached couplings are made from solid brass forgings and seamless drawn copper tubing to form a strong leak-proof assembly.

For fuel-oil hose . . . permanently-attached couplings by **SCOVILL**



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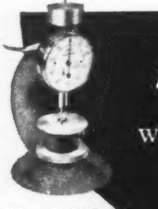

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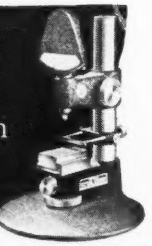

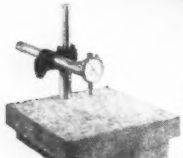

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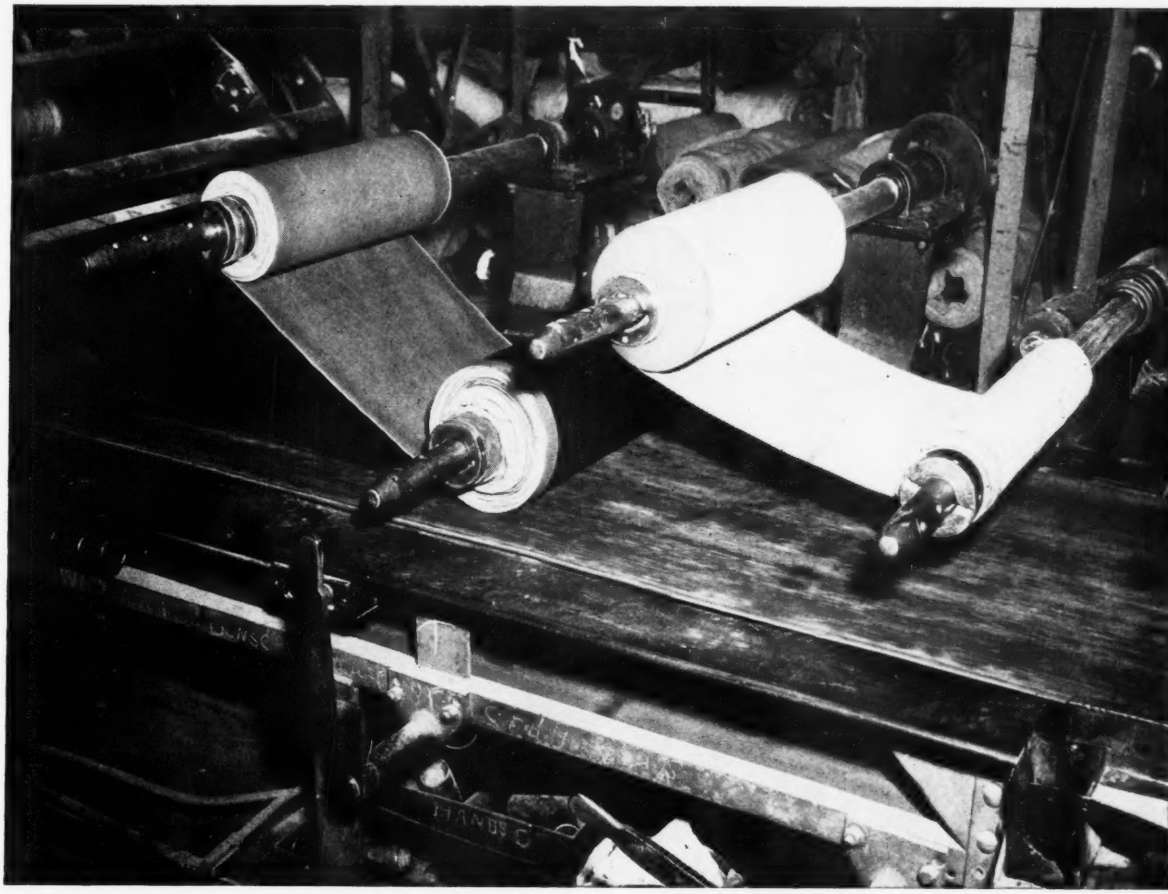

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RUBBER WORLD

EDITORIAL

JUNE, 1957

Natural Rubber Now Really at Crossroads

THE natural rubber industry, which in recent times has had to meet increasingly severe competition from the synthetic rubber industry, has really arrived at the crossroads this year. *The meeting of the International Rubber Study Group in Djocjakarta, Indonesia, later this month, therefore, could be the most potentially important meeting this organization has ever held.* This fact has been pointed out by the natural rubber growers' organization in this country, the Natural Rubber Bureau, in the May issue of its publication, *Natural Rubber News.*

The two major natural rubber producing areas in southeast Asia, Indonesia and Malaya, will both be independent countries by the latter part of 1957, and the future of natural rubber is more in the hands of the leaders of these countries than ever before. For the first time in the history of the natural rubber industry in February of this year, "Type Descriptions and Packing Specifications for Natural Rubber Grades Used in International Trade," were developed and adopted by the Rubber Manufacturers Association of the United States, and endorsed by 24 producing, packing, and consuming organizations in 13 different countries.

The American Society for Testing Materials' subcommittee 12 on crude natural rubber has begun the collection of data on certain technical properties of No. 1 and 1X Ribbed Smoked Sheets and No. 1X Thin and Thick Pale Crepes. The aim of the work of this group is eventually to establish technical specifications for these grades for consideration by producer and consumer interests. It must be emphasized again, however, that ASTM has no authority to enforce such specifications. *But as the president of ASTM, R. A. Schatzel, Rome Cable Corp., said last year, consumer yardsticks for raw materials and products must of necessity be developed in the present-day business world. Specifications, if necessary and desired, will then follow producer-consumer liaison.*

Assuming that an increase in the worldwide demand for natural rubber will follow the development of improved and special properties, satisfaction of the major part of this new demand may be unlikely until the early 1960's. Replanting with high-yielding stock to increase output has fallen short of predetermined target goals.

Meanwhile the synthetic rubber industry in the United States and elsewhere will have expanded its production capacity to 1.8 to 1.9 million long tons by 1960. Improvements are being made in existing elastomers, and new elastomers with special properties as well as those closely approaching the heretofore unduplicated desirable properties of natural rubber will be available.

Yes, the natural rubber industry is really at the crossroads now. With the proper approach, however, the future for natural rubber could be bright. RMA vice president and crude rubber committee chairman, W. J. Sears, pointed out in June, 1956, that the per pound cost of natural rubber could be reduced to a figure far below any foreseeable minimum for synthetic rubber, if the potentials of replanting with high-yielding stock could be fully exploited. *Forward-looking policies, aggressive business management, and political stability in the area could do much for natural rubber.*

R. G. Seaman

High-Temperature Aircraft Tires[1]

By L. J. KITCHEN
The Firestone Tire & Rubber Co., Akron, O.

It appears that high-temperature aircraft tires will have to be made with metal wire cord instead of organic tire cord. The use of metal wire cord will require design changes and possibly changes in load limits for such tires.

The high-temperature properties of several elastomers have been examined, and if the effects of heat degradation are added to the loss of tensile strength due to temperature alone, none of the so-called heat-resistant elastomers have tensile strengths as high as 500 psi.

In selecting elastomers for high-temperature tires, it is necessary to obtain more information quickly so that efforts will not be expended in developing elastomers inherently unsuited for high-temperature tires, or discard elastomers because they have been screened out by some arbitrary test that may have little relation to performance.

ACCORDING to an old Chinese proverb, "A journey of 10,000 miles begins with a single step." We have taken only the first step in the development of high-temperature aircraft tires. Unlike the journey of the proverb, the journey ahead of us in the development of hot tires is one of unknown length; furthermore, we do not know the best direction to travel.

What is a high-temperature tire; how high is high? The Military Advisory Committee on Aircraft Tires has recommended that the present aircraft tires, which are of *Hevea* rubber-nylon fabric construction, should not reach a temperature higher than 325° F. and should not be held at 325° F. for more than 10 minutes. This is the temperature as measured in the bead seat area. Therefore any tire which safely can be heat soaked at inflation pressure at temperatures above 325° F.—such as 500° F., or even 400 or 350° F.—for several hours without bursting or undergoing excessive deterioration can be described as a high-temperature tire.

The present development objective is to obtain an incremental improvement. It would be a significant advance in tire technology to develop an aircraft tire which could withstand heat soaking at 350 or 375° F. and could function at this temperature.

For a longer-term research objective, temperatures in the range 400 to 550° F. have been mentioned as the levels at which future tires must withstand heat soak-

[1] Presented at the Joint WADC-University of Dayton Conference on Elastomers for Air Weapons, Dayton, O., Mar. 27-28, 1957.

The Author

L. J. Kitchen, research administrative assistant, chemical and physical research laboratories, Firestone Tire & Rubber Co., obtained his B.S. in 1939, and his Ph.D. in 1943, both from the University of Florida.

Dr. Kitchen has been a research chemist since 1940. He was employed part time by the Glidden Co., Naval Stores Division from 1940 until 1943. He joined Firestone in 1943 and has been with the company since that time.

He is a member of the American Chemical Society and its Division of Rubber Chemistry, American Association for Advancement of Science, Sigma Xi, Phi Beta Kappa, Phi Kappa Phi, Akron Rubber Group, and the Akron Mineral Society.

Fig. 1. Passenger-car tire, 7.10-15, comparable with aircraft tire, 29 x 7.7, in size. Note the difference in plies to provide for the much greater load carried by the aircraft tire *(left)*

ing. Colonel H. C. Hamlin, of Wright Air Development Center, in his article in August, 1955,[2] suggested that tires good at 500° F. are needed.

We believe that insufficient data have been acquired on future temperature environments of aircraft tires. Air speeds of Mach[3] 1.5 to 3.5 have been related to aircraft skin temperatures, due to aerodynamic heating, ranging from 100 to 1000° F. But there is little information which relates skin temperature to tire temperature. If the dash period is short, in time a layer of insulation will protect the tire from excessive temperatures.

Indeed, current difficulties with aircraft tires involve factors other than aerodynamic heating conditions, factors such as (1) heat radiated from wheel brakes; (2) heat radiated to the tire from hot engine surfaces; and (3) overheating of tires which results from taxiing the plane long stretches on tires which are overloaded. Studies are needed which translate these various heating effects into actual service conditions, with due consideration for properly placed insulation for the tire compartment and for any cooling effect which can be introduced, such as air conditioning of the tire compartment, and lowering the tires into the air stream prior to landing.

TABLE 1. COMPARISON OF PASSENGER-CAR TIRE WITH AIRCRAFT TIRE

	Passenger-Car Tire	Aircraft Tire
Size, in.	7.10–15	29 x 7.7
Ply rating	4	16
Inflation pressure, psi.	24	220
Deflection, %	16	32
Load in service, lbs.	1,140	13,800

Service Conditions Severe

It should be realized that performance conditions for aircraft tires are very severe. Table 1 contains a comparison of service conditions for a 29-inch by 7.7-inch aircraft tire with those of a passenger-car tire of comparable size, the 7.10-15 tire. The passenger tire has a ply rating of four; the aircraft tire, a ply rating of 16. The aircraft tire is inflated to a pressure of 220 psi., compared with 24 psi. for the passenger tire, and the former operates at a deflection of 32%, compared with 16% for the passenger tire. The service load of the aircraft tire is 13,800 pounds, which is many times greater than the 1,140-pound service load of the passenger tire. (See Figure 1.)

Thus, the stresses on the rubber and the adhesives in the various parts of an aircraft tire are much greater than in a passenger-car tire. With this thought in mind, we will now consider what the effects of temperature are upon the properties of some of the materials in a tire.

When we study the high-temperature properties of elastomers and of organic fibers, we realize that there are two separate high-temperature phenomena to consider. On the one hand, there is the actual lowering of quality of the material which is due to heat degradation; and on the other hand, there is the decrease in strength of a material which occurs when the temperature of the material is raised. The latter effect is due to temperature alone, and it would take place even if there were no degradation of the material. The elastomeric vulcanizate or the textile fiber would have the lower strength even

[2] RUBBER WORLD, 132, 5, 601, (1955).
[3] Mach number is the ratio of the speed of an object to the speed of sound in the undisturbed medium in which the object is traveling. In air under normal conditions at sea level, Mach 1 is equal to 768 miles per hour.

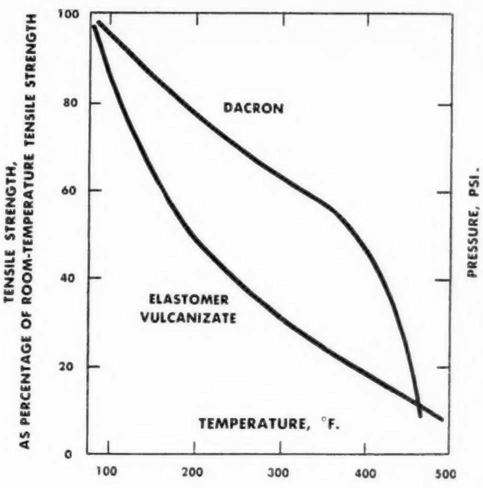


Fig. 2. Effect of elevated temperatures on tensile strengths of tire cord and an elastomer

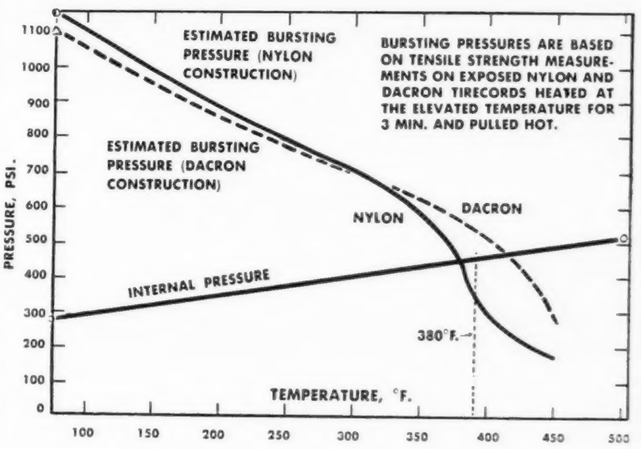


Fig. 3. Estimated internal pressure *vs.* temperature for aircraft tire having initial inflation pressure of 275 psi., and estimated bursting pressures *vs.* temperature for this tire with nylon and with Dacron constructions

if it could be brought to an elevated temperature instantaneously and evaluated before the high temperature caused any decomposition or other chemical change.

In Figure 2 are shown the effects of raising the temperature upon breaking strengths of an elastomer and of an organic textile cord. In each case the curve represents the percentage of the room-temperature tensile strength which the material retains at the test temperature.

According to these data the tire cord, which in this case is Dacron,[1] has about 45% of its room-temperature tensile strength when it is at a temperature of 400° F.

The elastomer curve is based upon an average of the tensile strength *vs.* temperature curves for a number of different elastomers. When an elastomer vulcanizate is tested at 400° F., it has only about one-fifth of the tensile strength which it would have if tested at room temperature.

For the organic textiles, the lowering of tensile strength with rise in temperature can be related directly to bursting strength and to resulting tire failure.

For the elastomers, it is not yet known whether the significantly lower physical properties encountered at 400° F. with the existing elastomers are sufficient for the tire to function at this temperature. It is not known exactly what levels of properties of the rubber are required for the tire to perform without failure. From data available thus far, however, it appears very improbable that a tire can be developed from existing materials which will function safely on today's aircraft at today's landing speeds when the tire is at a temperature above 400° F.

Fabrics for High-Temperature Tires

For reasons which I will not discuss here, glass, rayon, and cotton have been shelved so far as high-temperature tires are concerned, leaving nylon, Dacron, and metal wire to be considered. The tire-cord material presently being used in aircraft tires is nylon.

What is the effect of temperature alone on fabric strength? In Figure 3 is shown the estimated rise in internal pressure of an aircraft tire as the temperature is increased, with the tire having an initial inflation pressure of 275 psi. at ambient temperature. If the tire could be heated to 500° F. without rupture, the estimated internal pressure would be 514 psi., as calculated from the gas law.

Also in Figure 3 are shown calculated bursting pressures *vs.* temperature for tires constructed with Dacron and nylon, respectively. It is assumed that the initial room-temperature bursting pressure is 1,150 psi. for nylon construction, and about 1,100 psi. for Dacron. These curves are based on strength *vs.* temperature measurements of unprotected strands of cord which were heated at the test temperature for three minutes, then pulled. The results might differ slightly if the cords had been protected by rubber.

It is seen from Figure 3 that at a temperature of 365° F. the calculated bursting pressure for the nylon tire of 450 psi. crosses the line representing the internal pressure which increases with temperature. Theoretically the tire should fail at this temperature, if it did not fail from fabric pullout around the bead before reaching this temperature. Actually, a nylon aircraft tire, with this initial inflation pressure (275 psi.) and with this theoretical bursting pressure (1,150 psi.) at room temperature, was heated by one of the aircraft manufacturers until the tire failed; failure occurred when the inside of the tire reached a temperature of 380° F.

What is the effect of heat degradation upon the strength of nylon tire cord? If the tire were heat-soaked, there might be loss of strength due to degradation as well as that due to the temperature effect alone. We presently have only limited data on the effect of heat degradation

[1] Prepared from a polymer made from ethylene glycol and terephthalic acid. (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.)

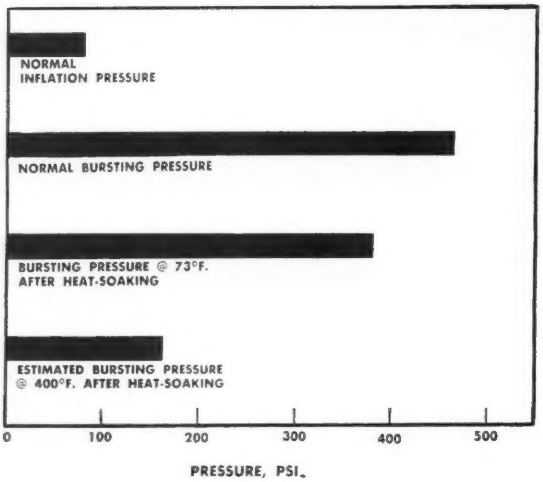


Fig. 4. Bursting pressure of aircraft tire (size 14.50) at 73° F., before and after heat-soaking eight hours in aluminum box placed in 412° F. oven

upon bursting pressure of an aircraft tire. At the December, 1956, meeting of the National Security Industrial Association in Washington, F. W. Stavely, of the Firestone research laboratories, described a test on an aircraft tire (size 14.50 SC) which was heat-soaked for eight hours while contained in an aluminum box—simulating the tire well in an airplane—which had been placed in a 412° F. oven. Temperature within the tire was 392° F. after four hours, and 411° F. after eight hours. The tire, when cooled, was subjected to a hydraulic bursting test at room temperature. It was found that the bursting pressure was 380 psi., compared to 465 psi. for a similar tire that had not been heated (Figure 4).

We do not know, of course, what the performance would have been if the bursting test had been conducted while the tire was at 400° F. Because, however, of the reduced strength which the tire cord would have at the elevated temperature, compared with its room temperature properties, it is probable that the bursting strength at 400° F. of the heat-soaked tire would have been on the order of 160 psi.

It is pointed out that Dacron is much more resistant to heat degradation than nylon, and that "Improved Type 700 Nylon"[5] has some superiority in heat stability over the Type 300 Nylon[5] used in the above experiments; but the residual strengths of both nylon and Dacron at 400° F., even before any heat degradation has occurred, are such that they are out of the question as tire fabrics in tires which are to be soaked at temperatures as high as 400° F. and landed while at the elevated temperature.

It is obvious that the margin of safety is insufficient to withstand the landing shock if the tire is at the elevated temperature when the airplane is landing. With the present construction of aircraft tires, e.g., an aircraft tire the size of a passenger tire having a 16-ply rating, it does not appear feasible to raise the bursting strength substantially by increasing the number of plies.

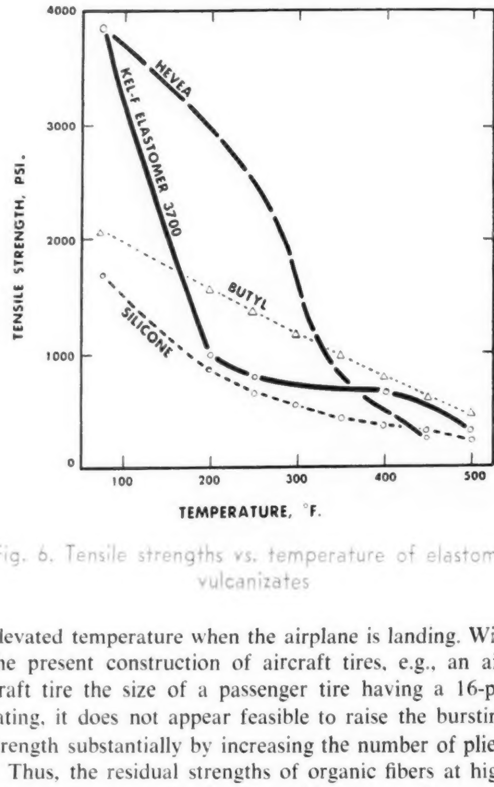


Fig. 6. Tensile strengths vs. temperature of elastomer vulcanizates

Thus, the residual strengths of organic fibers at high temperatures are such that it would appear to be necessary to use wire for an aircraft tire which will be heated at 400° F. The use of wire will involve development of an entirely new set of design features, including changes in the number of plies, in tread thickness, and in allowable deflection. Stronger wheels will be necessary to withstand the high inflation pressures which will build up when the contained gas is heated.

Load ratings and allowable deflections may have to go down if a switch is made from organic fibers to metal wire. Since wire has lower flex resistance than the organic fibers, it may be necessary to operate wire tires made with present constructions at deflections of 10 to 20%, compared with the 32% deflection at which

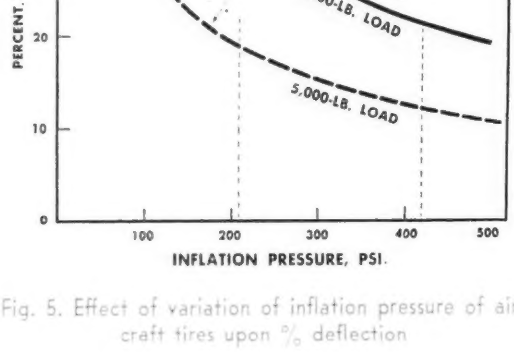


Fig. 5. Effect of variation of inflation pressure of aircraft tires upon % deflection

[5] Du Pont.

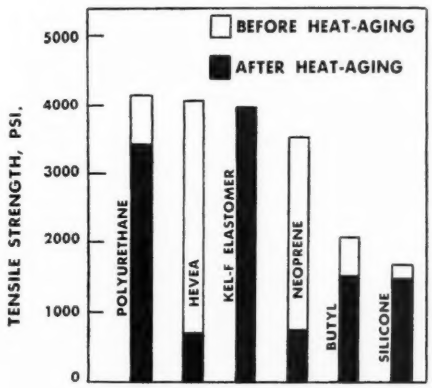
present nylon tires are operated. Lower deflections mean lower loads.

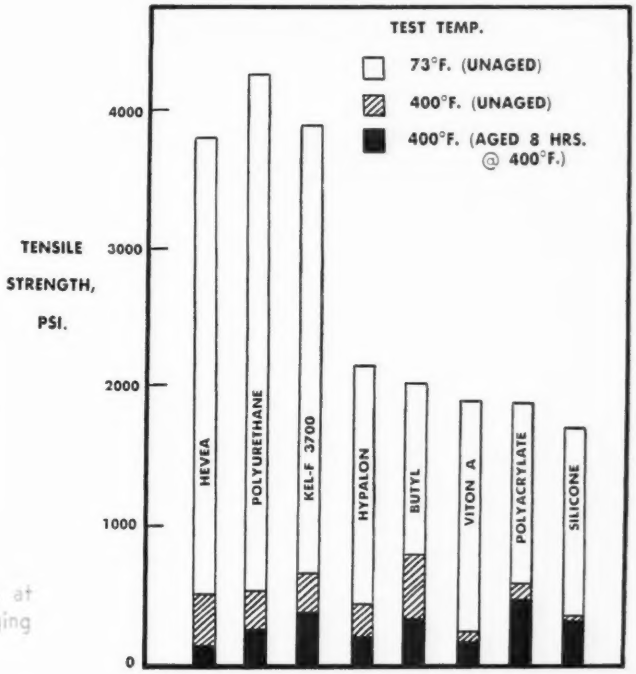
In Figure 5 is shown the relation between % deflection and inflation pressure for two sizes of aircraft tires. The upper of the two solid curves represents 30 x 8.8 tires; the lower one, 26 x 6.6 tires. There is a family of such curves for the various sizes of aircraft tires; but in every case the inflation pressure approaches infinity as the % deflection approaches zero.

For the 26 x 6.6 aircraft tire, the inflation pressure is 210 psi. and the deflection is 32% at the normal load of 10,000 pounds. With the same load on the tire, if the inflation pressure is doubled to 420 psi., the deflection drops to 22%; but from Figure 5 it appears almost impossible to lower the deflection to 15% by raising the inflation pressure, unless the load is decreased.

The dashed line in Figure 5 is the deflection curve for the 26 x 6.6 tire when the load is cut to 5,000 pounds, which is half of the normal load. At the 5000-pound load, with normal inflation pressure of 210 psi., the tire deflection is 18.5%, compared with the 32% deflection with the full load of 10,000 pounds.

Fig. 7. Tensile properties of vulcanizates before and after heat aging eight hours at 350° F.; measured at 73° F.





(Right)
Fig. 8. Tensile properties of vulcanizates at 73° and 400° F., before and after heat aging eight hours at test temperature

High-Temperature Properties of Elastomers

What are the properties of elastomers at high temperatures? In our studies for the WADC Materials Laboratory on the high-temperature properties of elastomers (summarized in Wright Air Development Center Technical Report No. 56-331), we tested available elastomers, both before and after heat-aging at temperatures up to the limits imposed by the elastomers themselves—that is, up to the temperatures at which the test vulcanizates decomposed during the test.

It was mentioned previously that an elastomer has only about one-fifth as much tensile strength at 400° F. as it has at room temperature. The tensile strength *vs.* temperature curves for the four elastomers, *Hevea*, Kel-F Elastomer 3700,[6] butyl, and silicone rubber, are shown in Figure 6. We believe that these data show the actual effects of elevated temperatures upon the tensile strengths of these particular test vulcanizates without intrusion of heat-aging phenomena except in the highest portion of the temperature range.

Why do some vulcanizates, such as the *Hevea* and Kel-F Elastomer vulcanizates of Figure 6, have tensile strengths of around 4000 psi.; while others, like the butyl and silicone vulcanizates for which tensile strengths are shown here, have only about half as much tensile strength? The marked enhancement of the tensile strengths of *Hevea* and Kel-F Elastomer stocks at room temperature is believed to be due, at least in part, to crystallinity on stretching. The contribution to tensile strength from crystallinity on stretching entirely disappears at high temperatures, apparently at temperatures above about 300 to 400° F. for *Hevea*, and at about 200° F. for Kel-F Elastomer.

In addition to crystallinity on stretching, there appear to be two other factors which contribute to tensile strength of elastomers. One of these factors is the enhancement of strength due to intermolecular attractive forces. These are the secondary valence forces, or van der Waals forces, between neighboring polymer chains; in many cases the effectiveness of these attractive forces greatly can be increased by use of reinforcing agents. Of the elastomers tested for the data in Figure 6, the *Hevea* and butyl stocks contained HAF black, the silicone stock contained an esterified silica pigment, and the Kel-F Elastomer contained no reinforcing agent.

[6] M. W. Kellogg Co. Division, Minnesota Mining & Mfg. Co., Jersey City, N. J.

The third factor involved in tensile strength of an elastomer vulcanizate is the strength of the basic network structure. This appears to be relatively small, but it seems to account for the residual strength of a vulcanizate at high temperatures (400-500° F.) at which there is no crystallinity on stretching and at which the van der Waals forces are very weak.

Compared to the hydrocarbon polymers, which have intermolecular attractive forces of intermediate strength, polar elastomers like nitrile rubber have stronger attractive forces, and fluorinated polymers, weaker attractive forces. In Figure 6 the tensile strength curve for the fluorine-containing Kel-F Elastomer falls rapidly to the plateau ascribed to basic network strength as the temperature rises.

It is concluded that much more fundamental study will be required before we can predict what level of tensile strength is attainable theoretically with an elastomer vulcanizate heated to high temperature (400-500° F.). Present data suggest that crystallinity on stretching will be of little help in this temperature range, if rubber properties at ambient temperature and below ambient temperature are to be retained. Therefore the fundamental studies should be directed at means of introducing strong cross-links and at means of developing stronger intermolecular cohesive forces at high temperatures.

Heat Deterioration of Elastomers

As was the case with the organic tire cords, we find that we must consider heat deterioration of elastomers in addition to the loss of properties that were just described, which are due to temperature alone. In Figure 7 are shown tensile properties, as measured at room temperature, of several elastomer vulcanizates before and after heat aging for eight hours at 350° F. The unshaded bars represent tensile properties before heat aging. The black bars are the tensile strengths as measured at room temperature after the vulcanizates had been heat aged for a period of eight hours in the 350° F. oven.

It is noted from Figure 7 that the saturated elastomers, polyurethane, Kel-F Elastomer, butyl, and silicone rubber, withstood the heat aging fairly well and retained two-thirds or more of the original tensile strength; whereas the unsaturated elastomers, *Hevea* and neoprene, showed extensive heat deterioration and retained less than one fourth of the original tensile strengths.

If the effects of heat degradation are added to the loss of tensile strength due to temperature alone, as by aging the vulcanizate at an elevated temperature and then testing at the elevated temperature, the tensile strength is reduced even more. The combined effects of heat aging and testing at 400° F. are shown in Figure 8. The white bars in Figure 8 represent the tensile strengths of the unaged vulcanizates. The cross-hatched part of the bar shows the tensile strength obtained when the unaged vulcanizate was tested at 400° F. Butyl had the best tensile strength at this temperature; but all of the tensile strengths measured at this temperature were below 1,000 psi.

The black bar represents the tensile strength, as measured at 400° F., after the vulcanizate has been oven aged eight hours at 400° F. and therefore shows how the tensile strength has been lowered by the two effects of raising the test temperature and heat aging the vulcanizate. With the exception of the *Hevea* vulcanizate, which is included here for comparison, these are the more heat-stable of the various elastomers which we studied in this manner. They include polyurethane rubber, Kel-F Elastomer, Hypalon,[7] butyl, Viton A,[8] polyacrylate, and silicone. None of the vulcanizates, however, had a tensile strength at 400° F. as high as 500 psi. after it had been oven aged for eight hours at 400° F.

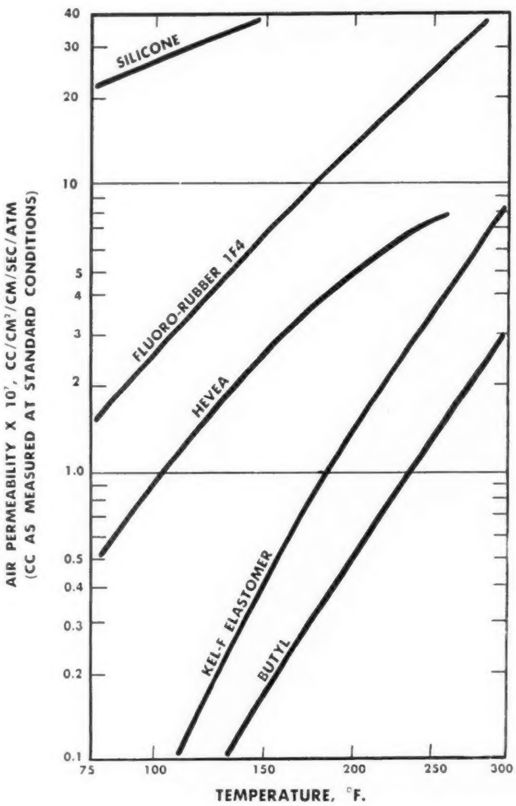


Fig. 9. Air permeabilities of elastomers

The comparisons of Figure 8 are not in themselves an accurate measure of quality because some of the elastomers lost much more elongation than others when aged and tested at 400° F., and some became hardened during the heat aging. For example, the *Hevea*, Hypalon, butyl, Viton A, and polyacrylate vulcanizates had elongations of less than 100% when tested at 400° F. after heat aging at 400° F.; whereas the silicone rubber had the highest elongation, 240%. The elongations of the heat-aged polyurethane and Kel-F Elastomer, when tested at 400° F., were intermediate, being 130 and 180%, respectively.

[7] Chlorosulfonated polyethylene. (Du Pont).
[8] Fluorine containing elastomer. (Du Pont).

High-Temperature Permeability Properties of Elastomers

Although we have described only the high-temperature tensile properties of elastomers, other properties are of equal or even greater importance for tire construction and for tire performance. These include properties such as resilience, modulus, tear resistance, hardness, permeability, building tack, ply adhesion, and adhesion to the tire cord and bead wire. There is not sufficient time to discuss all of these properties now; but we do wish to mention gas permeability as one property which has a very high temperature coefficient.

In Figure 9 are shown curves for the variation of air permeability with temperature, for several elastomers. The temperature range is from 75 to 300° F. In order to obtain permeability-temperature curves which are approximately linear, the logarithm of the permeability was plotted against the reciprocal of the absolute temperature so that the permeability curves of Figure 9 are similar to Cox Charts for the relation between vapor pressure and temperature.

TABLE 2. ESTIMATED TIME FOR 10% OF CONTAINED AIR TO PERMEATE THROUGH A 26 x 6.6 AIRCRAFT TIRE OF WIRE-CORD CONSTRUCTION

Elastomer	@75° F.—Hrs.	@350° F.—Hrs.
Butyl	31,500	68
Hevea	1,360	23
Silicone	29	3.5

In going from ambient temperature (75° F. on the graph) to 300° F. the air permeability of many elastomer vulcanizates increases one hundredfold.

Another interesting aspect of air permeability is the wide variation in air permeability among different elastomers. The vulcanizate stock shown in Figure 9 which has the lowest air permeability is butyl. Silicone rubber, at the top of the graph and having the highest air permeability, is 1,000 times more permeable to air at room temperature than is butyl. The other elastomers shown in Figure 9, Fluoro-Rubber 1F4,[9] *Hevea*, and Kel-F Elastomer, are intermediate between silicone and butyl in permeability to air.

Table 2 shows what these air permeabilities mean in terms of air loss from a tire. If a tubeless butyl tire of size 26 x 6.6, with wire-cord construction, were inflated to an air pressure of 210 psi. and were kept at room temperature, it would take about 30,000 hours for 10% of the contained air to diffuse through the tire. *Hevea* and silicone tires without special inner liners to reduce the rate of diffusion would require, respectively, 1,360 and 29 hours for diffusion of the same amounts of air.

If the tires which had been inflated to 210 psi. at ambient temperature, however, were held at a temperature of 350° F., the times for loss of 10% of contained air would be 68 hours for the butyl tire, 23 hours for the *Hevea* tire, and 3.5 hours for silicone construction.

[9] Minnesota Mining, St. Paul, Minn.

For tire materials which are susceptible to deterioration from oxidation at high temperatures, the effects of oxygen in the diffusing air may be of more concern than the loss of inflation pressure. Therefore, in the development of high-temperature tires consideration should be given to the use of nitrogen or an inert gas as the gas used to inflate the tire. Nitrogen has a lower rate of permeation through rubber than oxygen and also would diffuse through the tire at a lower rate than air.

Summary and Conclusions

Present aircraft tires are approaching temperature limits above which the use of organic fibers is not practical; and it now appears that high-temperature aircraft tires will have to be made with metal wire tire cord. The use of metal wire will require design changes and possibly changes in load limits, which would mean larger tires and larger tire wells in the aircraft.

In selecting elastomers for high-temperature tires, there is very little background of experience regarding the properties which are required for satisfactory performance at elevated temperatures. It is necessary to obtain more information quickly so that we will not expend our efforts in developing elastomers which are inherently unsuited for high-temperature tires, or on the other hand, discard elastomers from consideration because they have been screened out by some arbitrary test that may have little relation to performance.

In order to determine the actual performance of various types of polymers in aircraft tires at high temperatures, it will be necessary to make high-speed landing tests at the elevated temperatures at which the test tires fail. There are facilities at Wright Air Development Center for carrying out such tests at temperatures as high as 500° F.

Acknowledgment

The author thanks The Firestone Tire & Rubber Co. and the Materials Laboratory of Wright Air Development Center for permission to publish this paper. He thanks the following people for their cooperation in supplying data: T. F. Lavery, I. B. Prettyman, and F M. Smith of the Firestone research Staff, and R. D. Van Arman, of the Firestone tire development department.

Taped Synthetic Rubber Containers

Rayon tape is now being added to corrugated bulk containers made by Gaylord Container Corp. Division of Crown Zellerbach Corp., St. Louis, Mo., for shipment of up to 2,700 pounds of synthetic rubber. The tape increases the strength of the container and reduces bulging caused by the cold flow properties of the rubber. The new container holds up to 36 polyethylene-wrapped bales of rubber, and increase in the per unit load, and can be lifted on to a freight car by means of an ordinary fork truck.

Automotive Engineering With Urethane Foams[1]

By R. H. WALSH
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

A combination of technical and economic advantages indicates a promising future for urethane foam materials. Use as a seating material is one of the largest single potential markets for this foam.

Means have been developed for providing urethane foam with load deflecton characteristics, hysteresis properties, freedom from strain decay, resilience, and aging similar to those of natural rubber foam for use in seating applications.

Future applications of urethane foam materials for seat units, headliners, as foam-backed upholstery, crash-protecting devices, rug underlays, and as sound and heat insulating materials should increase the number of pounds of this type foam in the modern automobile from the present four to 24 in the next few years.

URETHANE foams have probably received as much publicity during the last two years as any other technical development in the United States. The imagination of the industrial engineer and the public alike has been fired with the potentials of a system which can produce cellular products varying from the hardness of rock to the softness of down, from the resilience of a steel spring to that of a putty. In addition, the facts that these foams are self-adherent to wood, fabrics, plastics, and metals, and can either be contour-molded or readily cut to any desired shape, have been added reasons for the enthusiasm shown by design engineers.

Beyond these technical advantages exist economic ones. Foam made from urethane polymer should cost less than that made from natural rubber latex. Actually, seats of comparable load-carrying capacity can be made from urethane foam at only one-half the weight of regular natural rubber foam. This possibility will result in lower raw materials cost especially as the price of the resin and isocyanate declines. Simplified manufacturing procedures for preparing these foams will result also in further cost reductions. This combination of technical and economic advantages cannot help but excite the interest of all potential users.

Commercial Status

The speed with which industrial engineers have accepted the concept of foam-engineering is readily apparent from the fact that urethane foams are already being produced commercially in fairly substantial volume. Approximately 8,000,000 pounds of foam were manufactured in 1956. Foams are being employed today in a number of industries ranging from transportation and furniture to clothing. Both rigid and non-rigid foams are being made as molded items and in slab form. Rigid foams are also being applied in the field as insulation.

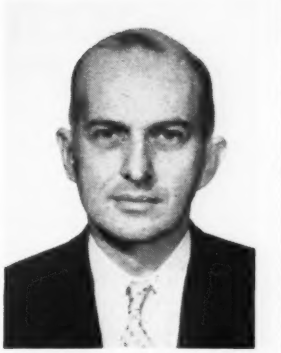
In the non-rigid field the automotive industry is using molded foam-padded instrument panels generally in their 1957 models. Foam-covered, pretrimmed armrests and drive-shaft tunnel support pads are also being molded. Two companies have equipped their '57 models with such units. Resilient foam slab stock is being slit into sheets for use as an acoustical lining in air conditioning ducts. In other parts of the transportation field an airplane company has approved a fully molded Teracol[2] (polyalkylene ether glycol) foam seat for its planes after 3000 flying hours of tests. In addition, fabricated seats are being prepared from slab stock made from polyesters. Both journal box seals and dust guards for railroad cars made from urethane foams are being field tested today on a substantial scale. In the clothing field, slit foam stock is being used for insulation by some sport-coat and children's wear manufacturers. A wide range of miscellaneous applications for slit stock has been developed varying from dunnage uses through clothing novelties.

In the semi-rigid and rigid fields, foam-insulated heater housings are being molded for use by one automotive manufacturer. Rigid foam slab stock is being fabricated into impact-resistant sun visors for another company. Foam insulated refrigerator doors are being produced by an eastern manufacturer of cold-storage units. The structural strength of the foam permits the use of lighter metal framing, with substantial savings in weight. The use of urethane foam for specialty-type insulation applications has also seen a small, but steady increase in the last year.

The present applications for urethane foams in the automotive industry can be classified generally into crash protecting, vibration dampening, and insulation-type uses. They are representative of fields wherein

[1] Presented before a meeting of the Society of Automotive Engineers, Detroit, Mich., Mar. 5-7, 1957. Contribution No. 117 of the Du Pont company.
[2] Du Pont trade mark.

The Author



R. H. Walsh

R. H. Walsh, head of the fluid systems division, elastomers department laboratory of the Du Pont company, received his B.S. in chemistry from Providence College in 1939.

He was employed as a development chemist by the United States Rubber Co., Providence R. I. from 1939 until 1942. He joined the Du Pont company in 1942 and worked on the development of neoprene latex until 1952; he was named head of the latex division in that year. Since 1953, when he was named head of the new fluid systems division, Mr. Walsh has been concerned with the development of urethane foam technology.

He is a member of the American Chemical Society and its Division of Rubber Chemistry, the American Society for Testing Materials, the Society of the Plastics Industry, and the Technical Assn. of Pulp & Paper Industry.

large volumes of urethane foam will be employed.

One of the largest single potential markets for this foam, however, is its use as a seating material. At present, no significant penetration has been made in this field. Progress has been delayed because the initial results of seating tests using the early type of polyester foams, in many instances were disappointing. These results can usually be traced to the fact that originally only one general type of polyester foam was commercially available. Thus it was submitted for every type of evaluation without regard for the requirements of the specific application. Today the formulation of foam and the application technology have reached the state where large-scale production of different types of seating units with specific physical properties is practical. Some of the recent technical advances that make this possible are the subject of this paper.

Specifications for Seating Materials

In evaluating a seating material, comfort under use conditions is the fundamental specification that is used to judge its acceptability. To many people, comfort is made up of both physical and psychological factors. For example, softness is associated with comfort; therefore the first feeling of a seat upon use must be soft or down-like. As the weight of the body sinks into the cushion, there must be a gradual and increasing resistance to penetration so that the body practically is cradled in the cushion. The seating material must also have sufficient compression resistance left to prevent bottoming during a severe bounce. Under dynamic conditions, the seat must also minimize side sway and road vibrations during use.

The appearance of the finished upholstered unit must also be attractive. The fabric must not hammock after use of the seat, and the welting must not ride away from the edge of the cushion. It is also essential that neither the upholstery fabric nor the seat becomes fatigued and sags after multiple flexings.

Numerous modifications must be made usually in a new seating material before all of these properties are incorporated in a single unit. Development of suitable urethane foams has been no exception. To obtain the necessary improvements the various components of a seating material that make it desirable must first be determined. These characteristics can then be analyzed in terms of known physical properties and their relation with the composition of the foam studied.

In the foam field a number of standard physical tests have been found that appear to correlate with the performance characteristics of a seating material. These include its compression deflection, hysteresis, strain decay, resilience, and flex fatigue properties. These characteristics of various types of urethane foams will be described, using the properties of natural rubber foam as controls.

Load Deflection Properties

The load deflection curves for foam made from rubber latex (6.1 lb./cu.ft. density) and a urethane foam (2.5 lb./cu.ft. density) made with a polyester resin are shown in Figure 1. The rubber foam curve follows the word specification outlined above for a desirable seating material. The urethane foam, however, has an initially high modulus which is translated practically into a crisp, harsh feel. A plateau section follows where only slight additional weight deflects the foam from 15 to more than 40% of its height. This condition results in a feeling of sinking into the cushion. The final third of the curve shows a rapid rise in the load required to deflect the foam the last 25 to 35%. This load, however, is only approximately one-half the value of natural rubber foam at 80% deflection. This results in the urethane foam bottoming more easily.

It is possible, however, to change the shape of the load deflection curve of urethane foams by at least three means: the type or chemical composition of the starting polyol can be changed; the foam can be compounded with modifying additives; or the foam can be modified mechanically by cutting and shaping.

As an example of the first method, polyether resin can be substituted for the polyester as the starting polyol. The curves shown in Figure 2 are for urethane foam made from two different polyether resins, a polypropylene glycol based resin, and Teracol. Both

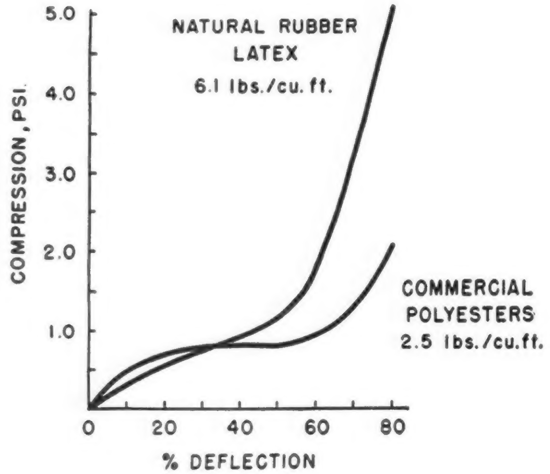


Fig. 1. Compression deflection properties of polyester urethane foam compared to those for natural rubber foam

curves show an initially low modulus and parallel the natural foam control curve through 50% deflection, eliminating the plateau section common to polyester foam. Beyond this point the resins fall below the control curve, although the Teracol foam has a higher compression than the other polyether.

Fortunately, recent work has shown how to raise substantially the major part of the last third of the compression-deflection curve. Small amounts of an elastomer are added to the foaming composition, preferably as a latex. The effect of adding 2% to 3% neoprene is shown in Figure 3. The curve for Teracol based foam at 2.5-2.7 lb./cu.ft. is actually higher than that of natural foam up to about 65% deflection, and at 2 lb./cu.ft. density, only slightly lower. The other polyether based foams also follow the rubber curve closely.

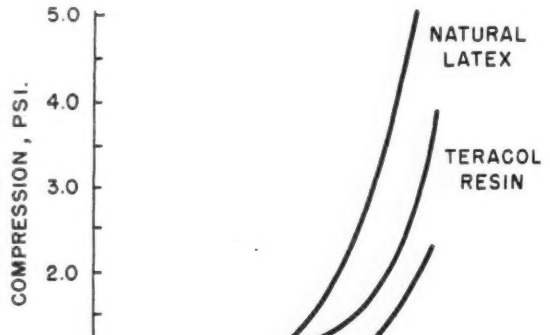


Fig. 2. Compression deflection properties of two polyether-based resin foams and natural rubber latex foam

Latex can also be used with polyester resins. When the latex is added to a polyester foaming composition compounded with the proper emulsifying agent, catalyst, and plasticizer, the load deflection of the foam (2.5 lb./cu.ft.) approximates the shape of the rubber control curve, Figure 3.

It is obvious to the engineer, of course, that other modifications can be made also in the load deflection properties by mechanical means. The foam can be shaped by either convolute cutting or geometric cutting to eliminate essentially the plateau portion of the compression curve.

Thus, chemical, compounding, and mechanical techniques are available for modifying urethane foams to give almost any desired form of load deflection curve.

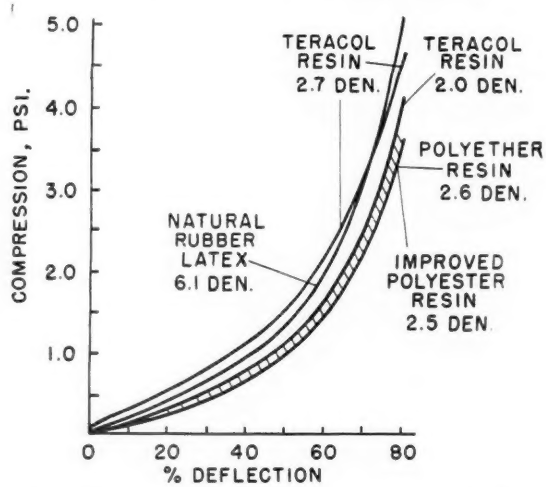


Fig. 3. Compression deflection properties of polyether- and polyester-based foams to which neoprene has been added, compared with natural rubber latex foam

Hysteresis

In our experiments the hysteresis properties of a foam and its rate of recovery after use can be correlated. Foams with a slow recovery rate usually have a high hysteresis or energy loss. Under ordinary use conditions, this results in the upholstery fabric "hammocking" as the body weight is removed from the seat. The fabric is left suspended in a baggy fashion across the indented area where the foam does not bounce back to its original height.

The original urethane foams made from available polyesters had high hysteresis properties and hammocked badly. Natural rubber foam has low hysteresis characteristics and performs satisfactorily in use. Urethane foams made from polyethers have hysteresis properties comparable to those of natural rubber and perform well in use tests. The improved types of foams made from compounded polyester resin also have much better hysteresis properties. Test data comparing the various types of foam are shown in Table 1.

The hysteresis values were calculated by measuring the areas under the loading and unloading curves of a compression-deflection test carried to 80% deflection.

TABLE 1. HYSTERESIS PROPERTIES OF URETHANE FOAM

Material	Density Lb./Cu. Ft.	Energy Loss, %
Urethane foam:		
Uncompounded polyester	2.7	49
Compounded polyester	2.6	29
Polyether resin	3.0	20
Teracol resin	2.5	17
Natural rubber foam	6.0	15
Steel springs	...	0–10

Then % energy loss, or hysteresis =

$$\frac{\text{area under loading curve} - \text{area under unloading curve} \times 100}{\text{area under compressed curve}}$$

Strain Decay

Seating tests made with urethane foam cushions have all included reports of adverse comments on the feeling of continually sinking into the cushion during use. The effect has been attributed to the plateau-like compression characteristics of this foam. Foam compressed to deflections of 60 to 70%, which is beyond this area, however, also exhibit the same feeling. This point suggests that the effect is more properly a strain-decay phenomenon. Foams made from compounded polyethers, Teracol, and polyester resin show less tendency to undergo strain decay than uncompounded urethane foam and have properties similar to those of natural rubber foam. Typical data from strain decay experiments are shown in Table 2.

Some of the experimental fully molded urethane cushions have sometimes exhibited a similar sinking feeling as to that associated with strain decay. It is not, however, the same phenomenon. It results from the presence of tight, heavy skin on the foam which holds air in the cushion, producing a pneumatic effect. It can also be caused by the presence of closed cells in the foam. In both cases there is a feeling of continued settling into the cushion as the air is slowly expelled during use. In the first case, use of a mold lubricant which produces a thin, open skin, or mechanical or electrical piercing of the foam surface, allows the air to escape rapidly and eliminates the problem. The second condition can be corrected by rupturing the closed cells during manufacture of the foam.

TABLE 2. STRAIN DECAY PROPERTIES OF URETHANE FOAM

Material	Orig. Height at 25% Deflection, In.	Height After One Min./ Dwell, In.	Orig. Height at 50% Deflection, In.	Height After One Min./ Dwell, In.
Urethane foam:				
Uncompounded polyester	0.75	0.62	0.50	0.40
Compounded polyester	0.75	0.70	0.50	0.45
Polyether resin	0.75	0.72	0.50	0.47
Teracol resin	0.75	0.72	0.50	0.47
Natural rubber foam	0.75	0.73	0.50	0.48

NOTE: The same samples identified in Table 1 were used for these tests. A 15- by 15- by 1-inch sample was used in this test. It was preflexed three times to 75% deflection, allowed to stand for five minutes, then compressed, using a 50-square inch standard RMA[3] foot to 25% deflection. An immediate compression reading was taken, and again after one minute. The test was repeated at 50% deflection.

TABLE 3. RESILIENCE PROPERTIES OF URETHANE FOAMS

Material	Resilience, %*
Urethane foam: Uncompounded polyester	35
Compounded polyester	50
Polyether resin	50
Teracol resin	59
Natural rubber foam	62

*ASTM D 945-55, Method D, American Society for Testing Materials, Philadelphia, Pa.

Resilience

Resilience tests are used to characterize the liveliness of a seating material. A correlation may exist also between resilience measurements and the tendency of a seat to side-sway. Tests have shown that cushions with low resilience have less tendency to sway. The lower resilience, as compared to rubber foam, of urethane foam made from polyesters was expected to solve this problem of transportation seating. The slow recovery rate of these foams was a psychological block, however, as yet not overcome. To many people a good seating material must still feel lively.

The resilience of foam made with polyester resin can be increased substantially by the same compounding techniques previously outlined. The resilience of foams prepared from the polyether and Teracol resins, while not numerically equal, are in the same class as natural rubber foam. Typical data are shown in Table 3.

Flex Life

Flex tests conducted on foams according to ASTM D 1055-49T at 50% deflection showed various rubber foams to decrease between 5% and 20% in compression properties after 250,000 flexings. Urethane foams also varied in their resistance to flexing. If the foams were properly cured, the changes in compression ranged between 10% and 35%, using the same test.

Of late, there has been interest in modifying the flex test by increasing the deflection from 50 to 75 or 90%. This change has been suggested as being more characteristic of many actual use conditions.

[3] The Rubber Manufacturers Association, New York, N. Y. Buyers' Specification—"Latex Foam" (As Revised Dec. 10, 1956).

Initial tests run in our laboratory on Teracol-based foams showed that some samples were no more affected by the more rigorous test conditions than when run at the original deflections. Other samples of Teracol foams, however, took a severe set. Two main factors were found to influence the performance of a foam in the test. The first was the amount of tack developed between the cell walls during flexing and, second, the state of cure of the foam sample.

Tack can be minimized by the use of an ester plasticizer and by the proper choice of surfactants for the foaming composition. A full cure is obtained in urethane foams when all of the isocyanate, water, and resin have reacted. In the case of Teracol, this is best accomplished by heat curing in the presence of some moisture.

Aging

HYDROLYTIC STABILITY. The properties of foams that we have discussed so far have been associated with its seatability under static and dynamic conditions. Paralleling these properties in importance as far as influencing the penetration of foam into the seating field, is the permanency of their properties. The best upholstery material must age satisfactorily, or it is of no practical use.

Over the last year the aging properties of urethane foams have received wide study and much discussion. In several cases polyester foams have failed to give satisfactory performance, becoming soft in only a few months of service. These have been isolated cases and not typical of the class. These experiences have demonstrated, however, the need of care in preparing these foams.

Hydrolysis of the urethane and urea links in the polymer was found to be the cause of poor aging of foam. This degradation is catalyzed by acid or alkaline conditions or the presence of hydrophilic material. Foams with satisfactory aging properties for many uses can be made from the present polyester resins by close control of the reactants during foaming. Further improvements in the aging properties of foams can be made by the use of hydrophobic polyols.

Natural aging tests have only been started on the improved types of foams during the last three years. So far they have aged well. On the basis of accelerated test, it is believed that these foams should perform satisfactorily for at least 15 or 20 years of normal use.

ELEVATED TEMPERATURES. Urethane foams perform very well at elevated temperatures. Both polyester and polyether foams age satisfactorily at temperatures as high as 240° F.

Normal operating conditions for foams usually do not exceed 240° F. For specific applications at higher temperatures, however, polyester foams should best be evaluated since the resin has a higher melting point than the present polyethers.

The Future

While not as yet commercially operable, several new laboratory techniques have been sufficiently developed to discuss them as possibly influencing the future thinking of the seating engineer.

A process for producing thin laminated sections of resilient foams and other coating materials has been developed. It is based on the use of a delayed-action catalyst. As little as 0.015-inch of polymer is knifed on to vinyl, paper, fabric, or metal, and heat activated to produce a uniform fine cell foam approximately 0.25-inch thick at 4 lb./cu.ft. density. Such a technique suggests the possibility of using these combined materials as insulating liners for cars, among many other applications.

An attractive uniform layer of either resilient or rigid foam at thickness as low as 3/8-inch can be sprayed even on to a vertical surface with two new different types of spray guns. Great uniformity is obtained. The technique can be used to insulate and provide structural strength to car parts.

Improved resins for rigid foam have been evaluated which can resist operating temperatures in excess of 300° F. and which are strongly flame retarding.

In the equipment field, production-type machines for filling individual molds are now available.

The many new facets of industrial design which result from the use of the chemical, physical, and mechanical properties of urethane foams appears to justify the expression "Engineering with Urethane Foams." Today present application for urethane foams in automobiles, if combined in a single model, would total four pounds. Potential applications for urethane foams in tomorrow's car exceed 24 pounds. These include fully molded seat units, headliners, foam-backed upholstery for sidewalls, doors and trunk liners, crash-protecting devices for the rear-seat rider, rug underlays, and rigid foams for sound and heat insulation on the fire wall and under the hood. Foam can be used also as an expanded adhesive on the underside of long spans of metal such as the rear fenders and deck to provide structural strength and sound-deadening properties. To employ wisely these foams and take advantage of their economies in required processing labor are the challenge to the automotive engineer.

Summary and Conclusions

It has been shown that the present-day interest in urethane foams rests on a technically firm foundation. The truth of this statement is further emphasized by the number of applications that have already attained commercial importance.

The use of urethane foam for seating applications represents one market that has not been penetrated. Data are presented in this paper that show conclusively that all of the deficiencies of the earlier type of foams for this application can be overcome by the use of the proper type of resin, compound, and present-day techniques for foam manufacture.

The progress that has been made is sufficiently great to warrant the careful reexamination of urethane foams by the industrial engineer who is concerned with seating applications.

Improved Sectioning Technique for Electron Microscopy of Carbon Black Stocks

By M. M. CHAPPUIS and L. S. ROBBLEE
Godfrey L. Cabot, Inc., Cambridge 42, Mass.

A procedure is described for obtaining very thin sections of carbon black-rubber stocks for examination for degree of dispersion in the electron microscope.

The sample is frozen to the desired hardness with dry ice in a special sample holder-freezing chamber, and sections approximately 0.05-micron thick are cut with a rotary microtome having a special feed.

IN A previous publication[1] a method was described for cutting ultra-thin sections of carbon black-loaded rubber stocks for examination under the electron microscope. The procedure involved embedding a thin strip of the stock in n-butyl methacrylate. The success of the method depended upon obtaining adequate penetration of the methacrylate monomer through the rubber prior to polymerization so that the sample would be firm enough for ultra-thin microtome sectioning.

The most serious difficulty encountered in this procedure arose from the fact that penetration of the stock by the monomer often resulted in excessive swelling. This limited the reliability of the conclusions drawn regarding state of dispersion of the carbon black in the original stock. To aggravate the situation, the degree of swelling varied with type of rubber and degree of vulcanization.

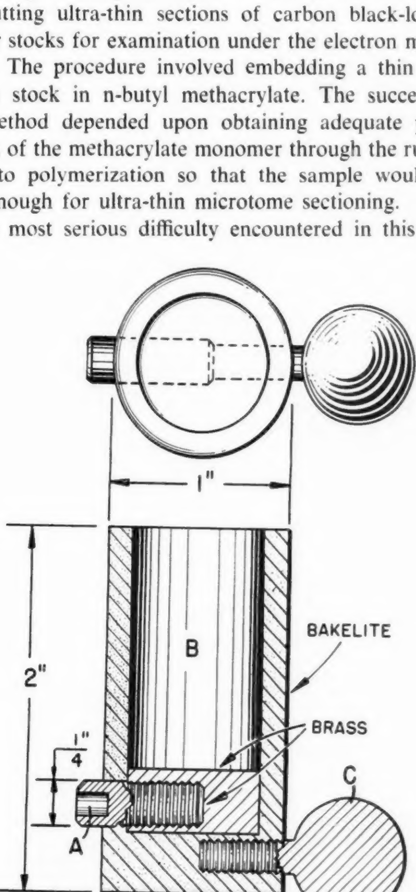


Fig. 1. Sample holder-freezing chamber: A, sample holder; B, freezing well; C, fixture which fits into socket on microtome

Butyl rubber stocks, on the other hand, showed very limited swelling in the methacrylate monomer, with the result that the embedded strip retained most of its original elasticity and could not be sectioned even though the surrounding polymethacrylate was of the desired hardness. At the other extreme, unvulcanized stocks swelled very excessively in the monomer.

A further drawback of the embedding technique was the fact that, in many instances, at least three days were required to effect proper polymerization of the monomer which was, of necessity, carried out without a catalyst. As a result of these difficulties, efforts were expended to develop a more rapid and reliable procedure.

We feel that the procedure described below is much more satisfactory in all regards. It is presently in use in this laboratory for electron microscope examination of black-loaded rubber stocks.

Procedure

The microtome,[2] the knife,[3] and the method of picking up and mounting the sections remain as described in the original publication,[1] with the exception that our microtome has now been adjusted so that the sample holder can be advanced as little as 0.025-micron. Originally our finest setting was only 0.05-micron.

The new procedure involves freezing the specimen to the required degree for optimum sectioning. A new

[1] RUBBER WORLD, July, 1954, p. 507.
[2] Minot international rotary microtome, International Equipment Co., Boston, Mass.
[3] Acme Glass Co., Cambridge, Mass.

sample holder-freezing chamber has been devised and is illustrated in Figure 1. We have constructed the freezing chamber from Bakelite[4] resin, and the sample holder and the base plate of the freezing chamber from brass, to provide good thermal conductivity.

In operation, the sample holder, A, is filled with water-diluted mucilage applied with a dissecting needle. A thin (<0.5-millimeter) strip of rubber is then suspended in the dilute mucilage. A powdered dry ice and alcohol mixture is firmly packed in the freezing well, B. The rubber strip is held centered in the sample holder until the mucilage has frozen. The brass plate at the base of the freezing well provides thermal contact between the freezing mixture and brass specimen holder.

The frozen rubber strip should extend from the sample holder just far enough to allow sectioning, and should be completely surrounded by frozen mucilage.

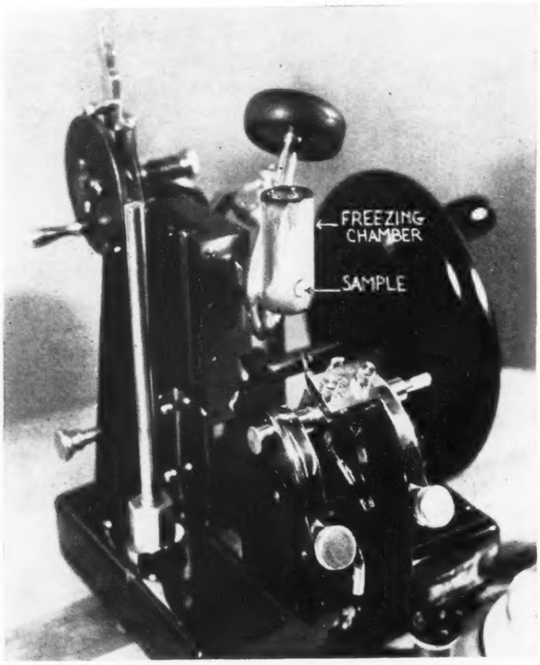


Fig. 2. Minot international rotary microtome equipped with sample holder-freezing chamber

Meanwhile the freezing well should be kept well filled with powdered dry ice. When the mucilage around the sample is completely frozen, sectioning can be begun. The frozen sample mounted in the holder is shown in Figure 2.

Results and Discussion

While the procedure is simple to describe, experience is, of course, a requisite. Skill, however, can be acquired quite rapidly, and then very thin, unswollen sections can be obtained in a small fraction of the time expended in preparing the methacrylate-embedded sections.

Series of sections can be readily cut with the advanc-

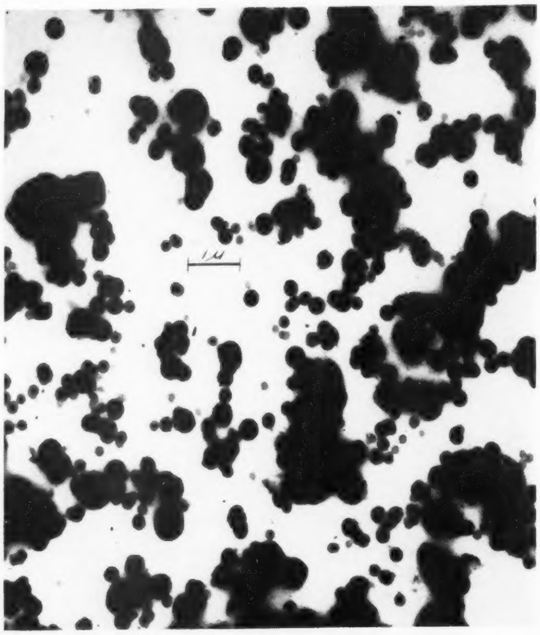


Fig. 3. Electron micrograph of section of a butyl vulcanizate containing 100 parts of medium thermal black (Sterling MT)

ing mechanism set at 0.05-micron. On rare occasions, ribbons of sections have been obtained with a setting of only 0.025-micron.

Very satisfactory electron micrographs of sections have been obtained from styrene-butadiene, SBR, and butyl, IIR, rubber stocks. The sections are thin enough

(*Continued on page 436*)

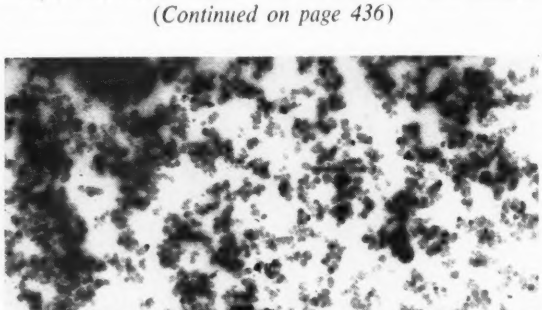


Fig. 4. Electron micrograph of section of cold SBR vulcanizate containing 50 parts of medium processing channel black

[4] Bakelite Co. Division, Union Carbide & Chemical Corp., trade mark.

MEETINGS and REPORTS

First Joint Rubber Division Conference A Success; 1957 Goodyear Medalist Named

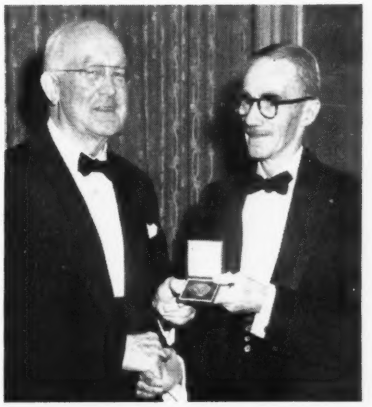
The 131st meeting of the Division of Rubber Chemistry of the American Chemical Society was held jointly with the Division of Rubber Chemistry of the Chemical Institute of Canada, in Montreal, P.Q., May 15-17, and was a most successful affair. This first joint conference of the American and Canadian Rubber Divisions attracted an attendance of about 1,350 persons, 791 of whom were members of the Rubber Division, ACS, 110 were members of the Rubber Division, CIC, 216 were non-members, and 199 were ladies.

Several special features of the joint conference contributed much to its success. Much credit must go to the local committee on arrangements headed by O. R. Huggenberger, Dominion Rubber Co., Ltd., who was also chairman of the Rubber Division, CIC. Through the efforts of this committee the officers of the sponsoring organizations were received at City Hall by Montreal's acting mayor, Murray Hayes, on the morning of May 15, and all registrants enjoyed the hospitality of the City at the Chalet at the top of Mount Royal Park on the evening of the same day, and on this occasion the acting mayor extended his welcome to all those present.

The Colwyn Medal, highest honor of the Institution of the Rubber Industry, of London, England, was presented to W. B. Wiegand, director and research consultant for Columbian Carbon Co., at the banquet on the evening of May 16. Mr. Wiegand made his Colwyn Medal acceptance speech at the technical session on the morning of the same day.

The selection of A. W. Carpenter, consultant, as the recipient of the Goodyear Medal of the Rubber Division, ACS, for 1957, was announced. Mr. Carpenter will receive the Goodyear Medal at the next meeting of the ACS Rubber Division, to be held in New York, N. Y., in September.

B. S. Garvey, Jr., Pennsalt Chemicals Corp., chairman of the Rubber Division, ACS, presided at the opening technical session on the afternoon of May 15, at the business meeting on May 16, and at the banquet on the evening of the same day. Recent actions of the Division's executive committee and proposed steps to strengthen the Division as well as nominations for new officers and directors were announced.



W. B. Wiegand, *left*, receives Colwyn Medal from G. Stafford Whitby

25-Year Club Luncheon Meeting

The eighteenth meeting of the 25-Year Club of the Rubber Division, ACS, was held on May 15, with N. S. Grace, Dunlop Canada, Ltd., and director from Canada of the ACS Division, presiding.

Dr. Grace welcomed those present to Montreal and conveyed a special welcome from Mayor Jean Drapeau. Dr. Grace mentioned McGill University of Montreal and men of the rubber industry in both Canada and the United States who had been associated with the University, such as G. Stafford Whitby, once a professor of organic chemistry at McGill, and W. B. Wiegand, the Colwyn Medalist.

Visitors from abroad were next introduced: namely, C. B. Copeman, publisher of the *Rubber Journal,* London, and a member of the IRI council; and Horace Dean, Chance & Hunt Co. Also introduced was H. G. Williams, of Harrisons & Crossfield, of Montreal.

A moment of silence was observed for those members of the 25-Year Club, A. M. Neal, E. I. du Pont de Nemours & Co., Inc.; R. A. Mathes, B. F. Goodrich Co.; Urban H. Parker, Dryden Division, Sheller Mfg. Co.; and E. A. Foote, Rubber Manufacturers Association, who had passed on since the last meeting.

Eight new members of the Club were then asked to stand and identify themselves, after which the member in attendance having the longest period of service in the rubber industry, not previously honored, was determined. The honor for the Montreal meeting went to Mr. Copeman, with 51 years of service with the *Rubber Journal.*

It was announced that the chairman for the next meeting of the Club, to be held in New York on September 10, would be W. O. Hamister, Naugatuck Chemical Division, United States Rubber Co.

Business Meeting—ACS

At the business meeting of the Rubber Division, ACS, Chairman Garvey first asked the members to stand for a moment of silence in tribute to those of the Division whose deaths had occurred since the last meeting: A. M. Neal, Du Pont; H. Connell, Armstrong Tire & Rubber Co.; E. B. Caldwell, Mare Island Naval Shipyard; L. F. Rogers, Continental Can Co.; and R. A. Mathes, Goodrich.

Recent actions of the executive committee were next explained, i.e., the appointment of S. D. Gehman, Goodyear Tire & Rubber Co., as associate editor *Rubber Chemistry and Technology*; the appointment of S. G. Byam, Du Pont, as acting secretary of the Division as a result of Dr. Neal's illness and untimely death; and the appointment of R. H. Gerke, U. S. Rubber, as Division secretary to fill out the unexpired term of Dr. Neal, following the Montreal meeting. Dr. Garvey paid special tribute to Mr. Byam's willingness to take over the duties of the secretary from Dr. Neal so that arrangements for the Montreal meeting might not be interrupted.

Certain steps being taken to strengthen the Division which will eventually be presented in the form of recommendations were described. A manual for the officers of the Division is being prepared. The positions of assistants to the secretary and the treasurer will be created, and the term of the secretary and the treasurer may be extended from one year to three years. Assistants to the editors and advertising manager of *Rubber Chemistry and Technology* may also be recommended.

The dates and places of future meetings of the Division were detailed as follows: September 11-13, 1957, New York, Commodore Hotel; May 13-16, 1958, Cincinnati, O., Netherlands-Plaza Hotel; September 9-12, 1958, Chicago, Ill., Hotel

Head table at the Conference banquet, *left to right*, A. E. Juve, B. F. Goodrich Co., past chairman, ACS Rubber Division; J. L. Macdonald, Du Pont Co. of Canada, chairman, Quebec Rubber & Plastics Group and co-chairman Conference arrangements committee; G. E. Popp, Phillips Chemical Co. and ACS Rubber Division treasurer; R. F. Dunbrook, Firestone Tire & Rubber Co., vice chairman, ACS Rubber Division; G. T. Page, general manager, CIC; H. L'Heureux, Consul General for the United States in Montreal; G. Stafford Whitby, University of Akron; W. B. Wiegand, Columbian Carbon Co., Colywn Medalist; B. S. Garvey, Jr., Pennsalt Mfg. Co., chairman, ACS Rubber Division

Sherman; May 12-15, 1959, Los Angeles, Calif., Biltmore Hotel; November 9-13, 1959, Washington, D. C., Shoreham and Sheraton Park hotels (International Rubber Technology Conference to be held jointly with Committee D-11 on Rubber of the American Society for Testing Materials and the Rubber and Plastics Division of the American Society of Mechanical Engineers); May 24-27, 1960, Buffalo, N. Y., Statler Hotel; September 13-16, 1960, New York, Commodore Hotel; May 16-19, 1961, Louisville, Ky., Brown Hotel; September 5-8, 1961, Chicago, Hotel Sherman; and May 15-18, 1962, Boston, Mass., Statler Hotel.

H. W. Hoerauf, U. S. Rubber, chairman of the membership committee, reported 2,544 members and 504 associates for a total of 3048 at the present time. The membership is somewhat less than it was on January 1, 1957, but is 90 more than the total in May, 1956. An attempt will be made in cooperation with the Rubber Division, CIC, to obtain more members from the Canadian area by emphasizing some of the extra services of the Rubber Division, ACS, that might be of interest to residents of Canada.

D. F. Behney, Harwick Standard Chemical Co., chairman of the nominating committee, reported the following slate of officers and directors for 1958: for chairman, R. F. Dunbrook, Firestone Tire & Rubber Co.; vice chairman, E. H. Krismann, Du Pont, and Sheldon Nicol, Goodyear Tire & Rubber Co.; secretary R. H. Gerke; and treasurer, G. E. Popp, Phillips Chemical Co. Nominated for directors from the areas served by certain of the local rubber groups were: Detroit, J. F. Stiff, Columbian Carbon, and R. W. Malcolmson, Du Pont; Rhode Island, R. W. Szulik, Acushnet Process Co., and R. B. Robitaille, Phillips Chemical; Washington, A. W. Sloan, Atlantic Research Corp., and G. W. Flanagan, B. F. Goodrich Chemical Co.; Northern California, C. A. Stephens, National Motor Bearing Co., and R. J. Reynolds, Shell Chemical Co.; Southern Ohio, F. W. Gage, Dayton Chemical Products Laboratories and K. C. Tregillus, Vernay Laboratories; Philadelphia, R. J. Salyerds, Harwick Standard, and M. A. Youker, Du Pont; and Connecticut, W. C. Carter, Pequanoc Rubber Co., and Harry Gordon, Bond Rubber Corp.

A. E. Juve, B. F. Goodrich Co., chairman of the Goodyear Medal Award Committee, announced that the award this year would be made to A. W. Carpenter, consultant, for his many contributions to the testing of rubber and rubber products.

Business Meeting—CIC

At the business meeting of the Rubber Division, CIC, the following officers and members of the executive committee were elected: chairman, H. K. Cunliffe, Dunlop Canada; vice chairman, J. A. Carr, also Dunlop Canada; and secretary-treasurer, W. H. Bechtell, Canadian General Tower Co. Mr. Huggenberger is the most immediate past chairman. Elected as members of the executive committee were Hector Lazzerotto, Polymer Corp., Ltd.; John Macdonald, Du Pont Co. of Canada; and Alex Jaychuk, Goodyear Tire & Rubber Co. of Canada, Ltd. Carl Croakman, Columbian Carbon, is the representative from the Ontario Rubber Section.

It was decided that the Division would meet with the Chemical Institute of Canada in 1958.

There was a brief discussion regarding arrangements now agreed upon concerning affiliation of the Ontario Rubber Group with the Rubber Division, CIC.

The Division was enthusiastic about the success of the first joint meeting with the Rubber Division, ACS, and the executive committee of the Canadian Division was directed to begin negotiations immediately with the United States Division for a second joint conference.

H. A. Braendle, Columbian Carbon, *left;* L. H. Krichew, Canadian Department of National Defense, *center*; and W. G. Forbes, Polymer Corp., Ltd., delivering their papers at the technical sessions

ACS Photos

Colywn Acceptance Paper

W. B. Wiegand, recipient of the 1956 Colywn Medal of the IRI, gave a paper in connection with the acceptance of the Medal before the combined American and Canadian Rubber Divisions at the technical session on the morning of May 16. The actual presentation of the Medal was made at the banquet on the evening of the same day.

Mr. Wiegand entitled his address "Carbon Black" and spoke first of the carbon black industry and his association with it from 1920 until the present time. He referred to his estimate in 1920 of carbon black as the "king of pigments." Mention was made of the various milestones in the technology of carbon black, starting with the fineness of subdivision criteria, the significance of pH, the con-

O. R. Huggenberger, Dominion Rubber, chairman, CIC Rubber Division; C. P. Copeman, *Rubber Journal*, IRI councillor; C. B. Purves, CIC president; C. S. Richardson, Q. C., member of Parliament from Montreal; Roy Avery, ACS News Service; H. K. Cunliffe, Dunlop Canada, Ltd., vice chairman, CIC Rubber Division; S. G. Byam, E. I. du Pont de Nemours & Co., Inc., acting secretary, ACS Rubber Division; R. H. Gerke, United States Rubber Co., secretary, ACS Rubber Division; and G. J. Baxter, Firestone Tire & Rubber Co. of Canada, Ltd., past chairman, CIC Rubber Division

tribution of electron microscope first used and developed at the University of Toronto in 1939 and used for the examination of carbon black on a Columbian Carbon fellowship, and the channel *vs.* furnace black developments of the 1930's.

The Medalist acknowledged a certain nostalgia in connection with his work with channel-type carbon black and gas-type furnace blacks. He said he could still hear the "squeal of the channels and the channel house pigs." The present-day dominant position of oil-type furnace blacks was still unquestioned, he added.

The Medalist devoted the major portion of his paper to what he called "the tentative dew line for hot mixed cold-rubber ISAF treads." Sweitzer[1] and collaborators have shown that carbon gel is a central factor in carbon reinforcement, it was said. A study of a "cold" (four minutes @ 250° F.) *vs.* a "hot" (10 minutes @ 388° F.) laboratory Banbury mixed cold rubber tread with 50 phr. ISAF black shows the usual change in physical properties from the cold to the hot mix, viz.: carbon gel up from 25 to 45%; rebound up from 55 to 57%; log resistivity up from 4 to 6; 300% modulus up from 1,950 to 2,760 psi; tensile strength down from 3,450 to 3,380 psi; elongation down from 485 to 425%.

Microtome sections cut from cured samples of these mixes which had been swollen and embedded in methacrylate monomers and later polymerized were photographed by W. Hess in the Columbian electron microscope at 25,000 diameters. The following features were observed: (1) Overall in going from cold to hot: increased contrast and differentiation. (2) Carbon phase in both mixes: relative absence of particulate carbon, ultimate units seeming to be carbon chain segments in various configurations. (3) Carbon gel complexes: in general, absent or small in the cold mix, prominent in the hot. These aggregates or clumps comprise closely packed carbon particles embedded in gel matrix. In the hot mix the carbon gel complexes tend to be large (equal to 40 particle diameters). (4) Clear areas: visible in both mixes, but more sharply defined in the hot, shape generally equidimensional.[2]

From the above facts it is deduced that: (1) Presence of numerous discrete clear areas implies that distribution of carbon must conform to that postulated in the discrete rubber theory (for *Hevea*)[3] rather than to that inherent in any uniform, particulate carbon theory. Some polymer entity either survives, or is generated, which is surrounded by carbon particles, but is itself free of carbon. The early maxima in the loading curve may now be rationalized without postulating any particular mechanism such as the survival of latex globules.[3] (2) Concentration of carbon in large gel complexes implies lower carbon content in the matrix as a whole: hence, higher log R and rebound, but, owing to carbon starvation, lower tear and tensile strength. (3) Presence of large carbon gel complexes implies, on deformation, fibering; hence higher modulus, lower elongation and tear.

In conclusion, Mr. Wiegand said that insofar as hot mixing promotes complete wetting of the carbon phase, the effect should be to raise reinforcement without reducing elongation or tear.

When hot mixing has been carried to the point of maldistribution of the carbon phase, with some areas over and others under populated, however, reinforcement becomes distorted, through fibering of the carbon gel complexes, in favor of modulus and rebound at too high a cost in tear, elongation, and, eventually, in tensile strength.

A tentative three-point warning against over heat treatment of LTP SBR-ISAF black tire tread might include that: (1) Tensile strength should not decline as against a control mixed under 300° F. (2) At a tight cure, elongation should not fall below some rigid specification, i.e., 500%, but depending on carbon loading. (3) Electron microscope transparencies should not show large (40 particle diameter) carbon gel complexes as predominant in the field.

The Technical Sessions

At the first technical session on the afternoon of May 15, Dr. Garvey presided and welcomed those present to the first joint meeting of the American and Canadian Divisions of Rubber Chemistry. The next meeting of the Rubber Division, ACS, scheduled for New York, September 13-15, was mentioned, with special reference to the deadline for abstracts of papers for this meeting, which is June 21.

Abstracts of the papers presented at the Montreal meeting appeared in the April issue of RUBBER WORLD. Some additional comment, however, on some of these papers might be of interest.

The first two papers dealt with the use of near-infrared spectroscopy for the anal-

C. P. Copeman, *Rubber Journal* and IRI councillor, *left*; N. S. Grace, Dunlop Research Center of Canada and ACS Rubber Division, director; O. R. Huggenberger, Dominion Rubber Co., Ltd., and chairman, CIC Rubber Division; and B. S. Garvey, Jr., chairman, ACS Rubber Division, *far right*

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[1] *Rubber Age*, 65, 6, 651 (1949).
[2] *Ind. Eng. Chem.*, 43, 2564 (1951).
[3] *Canadian Chem. Met.*, 21, 2, 35 (1937).

ysis of polymeric materials. M. J. Brock, Firestone, delivered the first paper, which described pyrolysis techniques for preparation of the polymers for analysis. In addition to the styrene-butadiene rubbers, natural, polyester and polyether, and acrylic rubbers could be determined qualitatively from the near infrared spectrum of single polymers or mixtures.

Quantitative analysis of mixed natural and SBR, or natural and butyl rubber, by an absorbance ratio method was described by K. E. Kress, also of Firestone.

A new rotary resilience machine that produces "continuous dynamic flexing," similar to that of an auto tire in use, of rings made of new rubbers permits the evaluation of these materials quickly for tires and also for motor mounts and other vibration absorbing rubber parts, was described by A. D. Dingle, of Dunlop Research Center, Toronto. D. Bulgin and G. D. Hubbard, Dunlop Research Center, Birmingham, England, were co-authors of this paper.

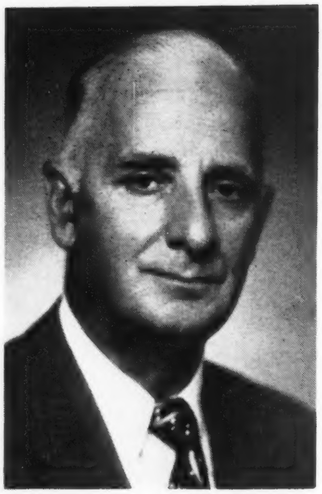
In the paper on temperature effects on elastomer flow patterns in the Mooney viscometer, David Craig and others at the B. F. Goodrich Research Center explained that the increase in Mooney viscosity during measurement found in some rubbers, and which has been called the Y value, results from the molecular weight and geometry of these polymers and some polymer breakdown during the initial period of running.

Melvin Mooney, in commenting on this paper, observed that there was need of more work of this kind and not so long after the development of a given instrument.

The use of an electronically instrumented impact pendulum for the evaluation of foam materials for shock and vibration absorption was explained by C. S. Wilkinson, Jr., of Goodyear. The penetration and deceleration curves obtained with this instrument were analyzed for natural rubber, urethane and vinyl foams. It was mentioned that the slope of the penetration or impact curve was useful in determining the value of a given sample of foam, with reference to the effect on the human anatomy when cushioned by the foam from acceleration at a given rate.

The abrasion machine described by Ira Williams, J. M. Huber Corp. was featured by a carborundum grit bonded with modified epoxy resin abrasive surface good for reproducible results for very long periods of time without replacement.

Lignin as a reinforcement for SBR in military tires was described in a paper by Lloyd Krichew, Canadian Department of National Defense; D. W. MacGregor, Howard Smith Paper Mills; and T. R. Griffith, Canadian National Research Council. When compared with carbon black reinforced SBR compounds, the lignin compounds indicated lower heat buildup and greater resistance to cracking with somewhat higher abrasion losses. Military truck tires using the lignin compound for treads showed good crack resistance and wear properties when tested on a gravel course. On an 85/15 pavement-gravel course performance of the lignin reinforced treads compared not unfavorably with carbon black reinforced treads.



R. H. Gerke, Division Secretary

A study of the moisture adsorption properties of carbon blacks was reported by E. M. Dannenberg and others of Godfrey L. Cabot, Inc. A wide range of blacks was studied under conditions of both high and low relative humidity, and it was pointed out that equilibrium adsorption data can be used as an approximate method of determining both volatile content and surface area of channel carbon blacks. The effect of high-temperature treatment on carbon black moisture adsorption was described.

The chemical constitution of carbon black surfaces was the subject of another paper by H. M. Cole, also of Cabot.

A new idea in mixing carbon black with SBR in the latex form without the use of dispersing agents for the black which gives "nearly instantaneous, complete and uniform mixing," and which, when used in tires, results in treads with improved wearing qualities, was explained by H. A. Braendle, of Columbian Carbon. It has also been found possible, and generally desirable, to add extending oil at the same time. A certain amount of dry mixing is still necessary to effect the penetration of the black into the rubber, but the use of large amounts of power and resultant damage to the rubber and carbon black from the power used in some methods of dry mixing is avoided. Rubber tread stocks mixed by the new method, when compared with conventionally mixed identical stocks of the same base rubber, have given improvements in road wear averaging about 15%, it was said.

Thermal diffusivity of butyl rubber compounds was said to be a function of pigment loading ranging from high to low with pigments such as HAF, MT, and SAF carbon blacks to whiting, by R. L. Zapp, Enjay Laboratories. The use of thermal diffusivity coefficients for calculating the time required to heat rubber slabs varying in thickness from 0.25 inch to 2.0 inches was explained.

Tack strength of various synthetic rubbers has been found to be related to the green tensile strength, and the ratio of green tensile strength to tack strength called "relative tack" has been found to vary with the shear viscosity of the polymer, according to W. G. Forbes and L. A. McLeod, of Polymer Corp. "Relative tack" can be altered by changes in molecular weight and chain entanglements. A new method of measuring tack strength of uncured polymers using fresh, reproducibly smooth rubber surfaces has been developed.

Recording research and development information and then processing these data for specific problems by means of an electronic statistical machine, in a fraction of the time required to do this work manually was described by R. F. New, of Enjay Labs. Sorting punched cards electronically may be accomplished at a rate of 450 cards per minute.

Preferred compositions of resorcinol-formaldehyde-latex compositions for bonding rayon and nylon cords to natural rubber were presented by M. I. Deitrick of Koppers Co., Inc.

In studying the effect of gamma radiation on elastomeric vulcanizates, B. L. Johnson and others at Firestone reported that irradiated natural rubber vulcanizates containing carbon black are superior to non-irradiated vulcanizates in tensile strength properties at 400 to 500° F. The gamma radiation presumably superimposes cross-links on the vulcanization cross-links to a high level while the natural rubber still retains adequate flexibility.

A better balance of physical properties of polyurethane elastomers can be obtained by curing with peroxides than with isocyanates, according to E. E. Gruber and O. C. Keplinger, of The General Tire & Rubber Co. Use of the peroxide cure also permits easier processing and stable storage of fully compounded stocks.

Copolymers of butadiene and acrylates may be cured more rapidly with a glycol-calcium oxide system than with metal oxides alone, it was pointed out by W. Cooper and T. B. Bird, of the Dunlop Research Center in England, and R. T. Woodhams of the Dunlop Research Center of Canada. Ethylene glycol was found to be a preferred material for use with the metal oxides.

Extender oils in SBR rubber in the presence of metal ions such as iron from the polymerization recipe promote the degradation of this type of rubber. Small quantities of inexpensive magnesium compounds, naphthenates or resinates, added to the extender oil prior to emulsification and coagulation of the latex-oil blend, have been found to be most effective in inhibiting this degradation, according to R. J. Reynolds, of Shell Chemical.

A fluorine-containing rubber, Fluorocarbon Elastomer 214, of the M. W. Kellogg Co. Division of Minnesota Mining & Mfg. Co., that is useful at high temperatures in contact with fuels and lubricating fluids, was described by J. C. Montermoso, and others of the Quartermaster Research & Development Center. This new rubber was developed as a joint effort of Kellogg and the Quartermaster Research & Development Command.

The Banquet and Medal Presentation

The banquet and Colwyn Medal presentation to Mr. Wiegand took place the evening of May 16 and attracted an attendance of 750 members and guests of the two Divisions.

Dr. Garvey presided and in his opening

remarks again paid tribute to the work of the local committee and to the City of Montreal for the success of the joint meeting of the American and Canadian Rubber Divisions.

The ACS Rubber Division chairman also mentioned again the passing of Dr. Neal, Division secretary, and called him a "friend of all the world."

The selection of A. W. Carpenter as 1957 Goodyear Medalist of the ACS Rubber Division was announced.

Officers and guests of the Divisions seated at the head table were introduced; next brief remarks were made by Mr. Huggenberger, representatives of the Canadian and American governments, the ACS, the CIC, and the IRI.

Mr. Huggenberger, as chairman of the Rubber Division, CIC, and of the local committee on arrangements for the joint meeting, expressed his appreciation of the success of the meeting and the new and important ties made. He acknowledged the very great help he had received from his local committee and introduced the committee members to those present.

H. L. L'Heureux, Consul General for the United States in Montreal, paid tribute to the City of Montreal, its officials, and residents.

C. S. Richardson, Q.C., a member of the Parliament from the St. Lawrence-St. George District of Montreal, extended his greetings to the members and guests of the Rubber Divisions.

C. P. Copeman, representing the IRI, expressed his appreciation of Canadian and American hospitality and mentioned the value of Anglo-American ties. In connection with Colwyn Medal presentation he mentioned that this medal was the highest honor conferred by the IRI.

C. B. Purvis, president of the CIC, extended greetings from the parent Canadian society.

Roy Avery, of ACS News Service, brought greetings from the parent American society officers to the members of both Rubber Divisions and the CIC.

G. Stafford Whitby, once professor of organic chemistry at McGill University and now professor emeritus of rubber chemistry at the University of Akron, and first recipient of the Colwyn Medal, in presenting the Colwyn Medal to Mr. Wiegand, described the medalist as:

"One who has contributed vastly to the founding and development of modern rubber technology; to a student of the behavior of rubber whose work through a lifetime has been marked by insight, by freshness and boldness of outlook, and by persistence in the pursuit of understanding."

Dr. Whitby said that the circumstances attending the presentation of the Colwyn Medal to Mr. Wiegand were particularly happy ones. First, because the presentation should take place at a joint Canadian-American meeting, for the Medalist was born and educated in Canada. Second, because of the British participation in the joint Canadian-American meeting by virtue of the presentation of the honor of the British society. Third, because it was in Montreal that Mr. Wiegand first entered the service of the rubber industry, and, fourth, because it was in Montreal in 1919 that Dr. Whitby first made the

ACS Photo

Reception for officers and directors of the Rubber Divisions, ACS and CIC, honored guests, and their ladies prior to the banquet

acquaintance of Bill Wiegand—an acquaintance that soon led to admiration and friendship.

Reference was made to Mr. Wiegand's first researches on carbon black in rubber, published in 1920, on the effect of black in raising the energy-storage capacity of rubber, which provided for the first time a rational basis for the study of rubber reinforcement. Dr. Whitby also paid tribute to Mr. Wiegand's ability as a writer, which, in turn, he said, contributed to the Medalist's broad interests in intellectual and literary matters far removed from carbon black.

Mr. Wiegand's approach to the problems of rubber compounding and rubber behavior has been primarily that of a physicist, and mention was made of his studies of hysteresis and the Joule effect. The Medalist was also credited with bringing to light the importance of such factors as particle size, pH, and "structure" as well as overall contributions to the theoretical understanding of the effects of blacks in rubber.

Mr. Wiegand's industrial career began with Dominion Rubber in Montreal, where he was technical superintendent from 1915 to 1918; he was until 1923 general manager of Ames, Holden, McCready Co., manufacturer of rubber and other footwear. When this latter company went into the tire business in Kitchener, Ont., Wiegand moved to Kitchener as managing director of the Ames Holden Tire Co. Since 1925, he has been in the United States, first as director of research for Binney & Smith Co. (1925-36), then as director of research for the Columbian Carbon Co., as vice president of the same company (1948-51); and since 1951 as research consultant and a director.

Mr. Wiegand became a Fellow of the Canadian Institute of Chemistry in 1920. In 1923 he was chairman of the Rubber Division, ACS. He joined the Institution of the Rubber Industry in 1923 and became a Fellow of it in 1925.

In accepting the Colwyn Medal, Mr. Wiegand expressed his appreciation to the IRI and for presentation in Montreal where his studies of carbon black and the rubber industry began. He paid tribute also to Great Britain as the country from which the honor came to him and to Mrs. Wiegand.

Following the actual medal presentation and Dr. Whitby's remarks, the banquet program was concluded by entertainment in the form of several fine variety acts.

Northeast Section Hears Polymeric Radiation Talk

David A. Trageser, Dewey & Almy Chemical Co., addressed 110 members and guests of the Elastomer & Plastics Group, Northeastern Section, ACS, on "Aspects of the Radiation Treatment of Polymeric Materials," following the organization's tour of his company's plant at Cambridge, Mass., April 23.

Mr. Trageser, a process development engineer, outlined the cross-linking and degradation effects of beta and gamma radiation on polymers. He described the effects of relative bond strengths, steric factors, crystallinity, and oxygen on the final properties and indicated the intensity of radiation needed to achieve specific results on materials, such as pasteurization, sterilization, cross-linking, and polymerization.

Various types of graft polymerization were described, as free-radical reactions in solids and solutions, and the effects of temperature, dose rate, film thickness, crystallinity, presence of oxygen, and tendency toward homo-polymerization were cited.

Comparative radiation costs were listed as follows: cobalt 60, 3¢ per pound-mega rep dose; cesium 137, 15¢, and spent fuel rods, 10-12¢. The speaker also compared the industrial treatment of liquids, sheet, films, and solids with electron bombardment and with gamma-ray radiation, as to efficiency, uniformity of treatment, depth of penetration, and relative cost.

Using slides, Mr. Trageser described the belt-type generator of High Voltage Engineering Co., the resonance transformer-type tube of General Electric Co., and the cobalt 60 source in use at Dewey & Almy.

The plant tourists were shown Dewey & Almy's balloon production units, a new pilot plant for elastomer development, can-sealing compound development and testing laboratories, the organic chemical research facilities, and the cobalt 60 radiation facility. The company is a division of W. R. Grace & Co.

Chemical Industries Show Scheduled for December

The twenty-six Exposition of Chemical Industries will be held at the New York Coliseum, New York, N. Y., December 2-6, with some 35,000 visitors expected to view the displays of about 500 exhibitors, according to E. K. Stevens, president of International Exposition Co., manager of the show.

Exhibiting firms are planning the most comprehensive array of chemical products and chemical process equipment since the exposition was established 42 years ago, Mr. Stevens said.

Butyl Symposium at Fort Wayne Meeting

The Fort Wayne Rubber & Plastics Group held its fourth meeting of the 1956-57 season at the Van Orman Hotel, Fort Wayne, Ind., April 11. There were 188 members and guests present for this dinner-meeting, which was featured by a symposium on butyl rubber.

The introduction to the symposium was given by Clifford A. Coffey, Enjay Co.: "Ozone Resistance and Weatherability of Butyl Compounds" was discussed by R. F. Neu, Enjay Laboratories; "Stability to Heat, Aging and Chemicals," by C. E. Waggner, Enjay Co.; and "Dynamic Properties," by R. L. Zapp, Enjay Labs.

Officers and directors of the Group elected for the 1957-58 season were announced as follows: chairman, George Kelsheimer, United States Rubber Co.; vice chairman, Phil Magner, Jr., General Tire & Rubber Co.; secretary-treasurer, Walter Wilson, R. T. Vanderbilt Co. Directors elected were Norman Klemp, General Tire; Ed Theall, Dryden Rubber Division, Sheller Mfg. Corp.; Hoyt Glassford, Sheller Mfg.; H. Cantwell, U. S. Rubber; John Lawless, E. I. du Pont de Nemours & Co., Inc.; R. Hartman, Monsanto Chemical Co.; Stan Choate, Tumpeer Chemical Co.; and Ed Bosworth, Columbian Carbon Co.

O_3 Resistance and Weathering

Mr. Neu first presented the results of a systematic study of compounding variables which affect the ozone resistance of butyl vulcanizates. Factors affecting the ozone resistance of such compounds include the state of cure, polymer grade, carbon black loading, plasticizer content, contamination with other polymers, and sulfur content.

Cure studies have shown that in a typical tetramethyl thiuram disulfide-mercaptobenzothiazole-type acceleration system optimum cure for ozone resistance is reached in about 20-25 minutes at 320° F.

The lower the unsaturation of the polymer the better is its ozone resistance. In this connection Enjay Butyl 035 and 165 were recommended. Contamination with other polymers must be avoided if maximum ozone resistance is to be obtained since even at a concentration of 0.5 to 1.0 phr. of SBR, the resistance of the compound is drastically reduced.

Carbon black type and loading have a considerable effect on ozone resistance, and furnace blacks at a level of 100-110 parts appear to be the best approach for a 75-80 Shore A hardness extrusion compound.

Up to 10 parts of plasticizer is not too detrimental to the ozone resistance of butyl rubber compounds, and petrolatum shows an advantage over some other petroleum and coal-tar oils in such compounds.

Sulfur level exhibits a marked influence on ozone resistance, and above 1.6 phr. of sulfur, bloom problems will be encountered that cannot be overlooked in many applications, it was said.

Wax is not particularly effective in improving ozone resistance of butyl rubber compounds, and antiozonants must be brought to the surface and remain there to be of value. In general, it is better to compound butyl rubber for maximum ozone resistance without the use of such additives as wax and antiozonants.

All of the trends and conclusions mentioned above, based on exposure to 0.2% ozone in a test cabinet, have been borne out by subsequent testing in the 50-parts-per-100-million chamber and have generally been confirmed by outdoor aging studies in southern California, Florida, and New Jersey, it was said.

Heat, Aging, Chemical Resistance

Since heat degradation of butyl rubber is the result of the breaking of disulfide linkages, the rate of degradation or useful life will depend on the number of such linkages initially present, Mr. Waggner said. Enjay Butyl 325 and 365, grades containing the highest unsaturation possible, are the most heat resistant of the butyl polymers.

Carbon blacks of the fine and medium diameter furnace type are the best for heat stability and are generally used at about the 60-phr. level. Since the stability of the vulcanization cross-link is the weakest part of the vulcanizate toward high temperatures, the quinoid-type cure results in more stable cross-links than the sulfur-type cure.

The use of a cure system utilizing Amberol ST 137[1] (isooctyl dimethylol-phenol resin) in combination with certain specific metallic halides, such as the dihydrate of tin chloride was reported to give excellent aging properties with a very low permanent set. This system is covered by United States patent No. 2,726,224 issued to U. S. Rubber Co.

Addition of 81,000-99,000 Staudinger molecular weight polyisobutylene gives marked improvement in heat aging with a sulfur-cure system. Addition of 5 pph. of SBR or natural rubber will also improve the heat aging of butyl compounds, but should *not* be used in compounds where ozone resistance is also desired.

The low unsaturation of butyl rubber gives it unusual resistance to chemical attack. It is resistant to acids, oxygenated solvents, such as ketones, esters, and alcohols. Resistance is fair to certain aromatic and halogenated solvents. Because of similarity of chemical structure between butyl rubber and aliphatic hydrocarbons, the latter do cause swelling. Enjay Butyl is remarkably resistant to most oils of non-mineral origin and exhibits low swell in vegetable and animal oils.

For acid resistance, the low unsaturation grades, Enjay Butyl 035 and 150, are the best; while the faster curing grades, 215, 217, 218, and 325, are preferred for commercial handling.

The higher surface area furnace black yields vulcanizates having low-volume swell and should be utilized for good chemical resistance wherever possible. Filler loadings of 20-30 volumes should be used for acid-resistant applications. Heat treatment, i.e., thermal interaction of blacks with the polymer using a chemical promoter, improves acid resistance. High filler loading improves resistance to organic chemicals. Mineral fillers should be avoided where good chemical resistance is required.

In many cases non-sulfur cures exhibit improved chemical resistance over the conventional sulfur cure. The sulfur cure, however, is superior in the case of exposure to strong oxidizing agents such as sulfuric or nitric acids.

Mr. Waggner concluded his remarks with some observations on the processing of butyl rubber. Banbury mixing is ideal for butyl rubber, and approximately 10% larger volume loads may be charged than when mixing natural rubber.

Enjay Butyl of low Mooney viscosity is best mill-mixed on a cold, tight-set mill. When high Mooney viscosity grades are being mixed, an initial mill temperature of about 165° F. is suggested.

Heat treatment of Enjay Butyl improves resilience, modulus, hysteresis, and tensile strength in some cases. Without chemical promoter, heat treatment in the presence of surface active channel blacks uses Banbury mixing cycles of 20 minutes above 400° F. With furnace blacks, heat treatment requires the presence of sulfur and zinc oxide. Heat treatment may also be accomplished with chemical promoters such as Polyac,[2] GMF or dibenzo GMF,[3]

[1]Rohm & Haas Co., Philadelphia, Pa.
[2]E. I. du Pont de Nemours & Co., Inc., elastomers department, Wilmington, Del.

Butyl symposium panelists, *left to right*, C. E. Waggner, Robert L. Zapp, Robert F. Neu, and Clifford A. Coffey

or Elastopar,[4] along with carbon blacks in the Banbury at various temperatures. Heat treatment without promoters is not economically feasible in plant operations.

As would be expected, FEF blacks are the best for butyl extrusion compounds. Extrusion rates of loaded compounds may be increased by proper balance between fillers and softener.

Higher calender temperatures are required with butyl rubber than with natural rubber compounds, and, in general, the higher the roll temperature, the less the tendency to form blisters. Roll temperatures above 170° F. result in smooth sheets with a minimum of shrinkage.

Dynamic Properties

In discussing the dynamic properties of butyl rubber, Mr. Zapp first referred to diagrams of undamped, damped, and highly damped elastic systems and discussed the relations between dynamic deflection, static deflection, damping factor, frequency of applied force, and the natural frequency of such systems. The damped and highly damped systems are representative of rubber vulcanizates, with the damped system considered as natural rubber, and the highly damped system as butyl rubber.

For frequencies removed from resonance, the natural rubber compound would isolate vibration well, but its lower damping factor presents the possibility that higher resonance amplitudes could be encountered than with butyl rubber. The higher damping factor generally encountered in butyl rubber compounds absorbs shock energy more completely. The part of the rubber article made from butyl, however, would necessarily have to be designed to take care of the higher heat buildup.

Butyl rubber becomes more resilient or has lower hysteresis loss as the temperature of operation rises. In addition, the frequency dependence is changed as temperature is increased. At room temperature, for example, the butyl vulcanizates are quite frequency dependent, and as temperature rises, not only does the hysteresis loss go down, but it becomes less frequency dependent. At much higher or audio frequencies, the higher damping of butyl can be utilized in sound-damping. This feature of butyl rubber contributes to the lower noise level of experimental butyl tires, it was pointed out.

The dynamic properties of butyl rubber can be greatly altered by compounding. Plasticizers, either oils or aliphatic esters reduce the hysteresis loss of butyl vulcanizates. The heat treatment of butyl rubber with carbon black also greatly alters the hysteresis properties of this-type rubber.[5]

In general, however, butyl vulcanizates are dynamically softer than corresponding SBR and natural rubber vulcanizates containing the same volume and type of pigment. This fact is shown when a comparison is made between the dynamic constants of the natural rubber compound and those of butyl. The natural rubber compound is dynamically harder, but more resilient, as is shown by the values of 2.7 and 4.1 for the dynamic modulus and the values of 35 and 28% for the relative damping. These constants were determined at 16 cycles per second at 50° C., it was said.

This quality of lower dynamic modulus or higher dynamic softness coupled with greater energy absorption can be utilized in the design of shock-absorbing members or parts. A butyl shock-absorbing member can operate through a greater deflection absorbing more energy in the process. Such a combination has been utilized commercially in the design of rubber load bearing members in trailer trucks. These load cushions give a soft, easy ride within the complete range of loads. These members utilize the greater dynamic softness and the higher energy absorption of butyl vulcanizates to produce this effect, Mr. Zapp said in conclusion.

[3]Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.
[4]Monsanto Chemical Co., organic chemicals division, St. Louis, Mo.
[5]Rubber World, Dec., 1956, p. 413.

Rubber Coating Symposium Given at Washington Meet

Harry Berry, Gates Rubber Co., Denver, Colo.; G. K. Vogelsang, Gates Engineering Co., Wilmington, Del.; and Fred W. Weber, Products Research Co., Los Angeles, Calif., were the featured speakers at the April 17 meeting of the Washington Rubber Group at the Pepco Auditorium, Washington, D. C.

The 50 members and guests in attendance heard Mr. Berry, talking on "Rubber Tank Linings," outline what he considered the most satisfactory method of arresting tank corrosion—by lining all inner surfaces of the vessel with sheets of rubber which are vulcanized in place.

The Gates Rubber corrosion engineer stressed economical solutions to the problem, discussed the types of elastomers available to meet service conditions and how to select them, delved into the ASME coded *vs.* non-coded tank classification, and described pressure ratings for tanks.

Dr. Vogelsang's subject was "Elastomeric Coatings and Coverings." He reviewed the various elastomeric coatings that lend to the preparation of solution coatings and which can be applied by brushing, dipping, spraying, or roller-coating.

Thin coatings can provide the same type of protection as thick linings, the Gates Engineering Co. director of research said, except that there will be a reduction in the severity of the service or in length of service. Natural rubber, neoprene, Hypalon, polyacrylic rubber, nitrile rubber, and Kel-F Elastomer were among the coatings he talked about.

Products Research President Fred W. Weber discussed "Thiokol Liquid Polymers and Their Use as Coatings and Sealants." These liquid polymers, made from dichlorodiethyl formal, are applied directly to the structure and cured in place to form an elastomeric rubber covering without seams and well-bonded to the base structure.

The material has such uses as fuel-tank sealants in aircraft, pressurization systems in airplane fuselages, cargo tanks carrying oil, deck caulking compounds, and sealings for the expansion joints in concrete construction.

The May 15 meeting of the Washington Rubber Group featured Silas Braley, Dow Corning Co., who discussed "The Newer Silicone Rubbers and the Fluorosilicone Rubbers," and A. C. Stevenson, E. I. du Pont de Nemours & Co., Inc., who spoke on "Viton-A, a New Fluorine-Containing Rubber."

The Group is planning a full day's program in February, 1958, in celebration of its tenth anniversary. The day's activities will include a luncheon, an afternoon technical meeting, dinner, and a non-technical after-dinner speaker. Details will be arranged later.

Braley, Stevenson Address Group's May 15 Meeting

Silas A. Braley, Jr., Dow Corning Corp., and A. C. Stevenson, E. I. du Pont de Nemours & Co., Inc., were the speakers at the technical session of the May 15 meeting of the Washington Rubber Group at the Pepco Auditorium. Twenty members were present.

Speaking on "The Newer Silicone Rubbers and Fluorosilicone Rubbers," Mr. Braley discussed the fluorosilicones, valuable for their solvent and fuel resistance, particularly at very low and at very high temperatures; silicone rubber potting and caulking materials that vulcanize at room temperatures; conductive silicone rubbers; and silicone rubbers with exceptionally good tensile and tear properties.

The properties, fabrication, and application of these materials were detailed, together with the principles of silicone rubber chemistry and compounding. Several new uses of standard silicone rubbers were given.

Mr. Stevenson, speaking on "Viton A—a New Fluorine-Containing Rubber," described Viton A as a special-purpose elastomer which combines remarkable chemical and thermal stability with reasonable physical properties and good processability. A copolymer of vinylidene fluoride and hexafluoropropylene, it can be vulcanized with a variety of polyamines or organic peroxides, as well as by radiation.

The processing and curing of Viton A is conventional except that a high-temperature post-cure is necessary for optimum properties. The elastomer has outstanding resistance to a variety of fuels, lubricants, and chemicals. It is currently available only in experimental quantities.

Newly elected officers of the Group are as follows: president, Douglas K. Bonn, United States Rubber Co.; vice president, Robert D. Stiehler, National Bureau of Standards; secretary, Arthur Sloan, Atlantic Research Corp.; and treasurer, George W. Flanagan, of the B. F. Goodrich Chemical Co.

Special-Purpose Elastomers Are Panel Topic at Detroit

Five papers on special-purpose elastomers were presented during the technical session of the April 12 meeting of the Detroit Rubber & Plastics Group at the Detroit Leland Hotel, Detroit, Mich.

The speakers and their subjects were the following: G. A. Daum, B. F. Goodrich Chemical Co., Cleveland, O., "Polyacrylic Elastomers"; F. J. Honn, Minnesota Mining & Mfg. Co., Jersey City, N. J., "Kel-F Elastomer"; H. G. Schwartz, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., "Viton A"; D. A. Stirers, Minnesota Mining & Mfg. Co., St. Paul, Minn., "Fluoro-Rubber 1F4"; and T D. Talcott, Dow Corning Corp., Midland, Mich., "Silastic LS-53."

The moderator was R. C. Waters, G. M. Truck & Coach, Pontiac, Mich. A Bell Telephone Co. color film, "Our Mr. Sun," was shown after dinner. Herman Viewig, United States Rubber Co., a member of the Association of Applied Solar Energy, commented on utilizing solar energy.

Addressing the 150 members and guests present at the technical session, Mr. Daum reviewed the technology, properties, and commercial applications of the polyacrylate rubbers, including Goodrich's Hycar 4021, a polyacrylate elastomer of the "EV" type, and Borden Co.'s Acrylon EA-5 and Acrylon BA-12, which are basically copolymers of acrylonitrile with either butyl or ethyl acrylate.

Also available, but in quantities for development work only, are Hycar 2121X26 and Hycar 2121X27, which are experimental polyacrylic elastomers.

The most outstanding feature of polyacrylate rubbers is their ability to perform in sulfur-modified oils (extreme-pressure lubricants) at temperatures in excess of 350° F. This property is due to the absence of any residual unsaturation in the polymer. These rubbers are commercially important in such applications as automotive transmission seals and gaskets, O-rings, oil hose, belting, tank linings, white or pastel colored goods, and gaskets.

Advantageous properties of the polyacrylic elastomers include their resistance to swell and to deterioration in extreme-pressure lubricants, excellent ozone resistance, tensile strength of 1,500 psi. at 200° F., and low-temperature resistance to —10° F. Although the water resistance of these elastomers is poor, this can be improved by varying the ester groups in the polymer chain, with some loss in oil and heat resistance.

Mr. Honn's talk (covered previously in RUBBER WORLD, March, 1957, page 891) dealt with Kel-F Elastomers- 5500 and 3700, fully saturated copolymers of chlorotrifluoroethylene and vinylidene fluoride noted for their extreme thermal stability and outstanding resistance to fuels, oils, and corrosive chemicals. The elastomers have found application in the aircraft, chemical, and electrical industries for such products as gaskets, diaphragms, O-rings, seals, hose, tubing, and cable jackets.

Mr. Schwartz described Du Pont's new special-purpose fluorine-containing elastomer, Viton A, said to combine remarkable chemical resistance with exceptional heat resistance and good mechanical properties. Conventional rubber processing equipment may be employed. The speaker detailed methods of compounding and curing of Viton A stocks and gave data on heat resistance and fluid swell characteristics. The elastomer is currently available in small quantities for special purposes.

Mr. Stirers declared that 3M Brand Fluoro-Rubber 1F4 (formerly Poly FBA) was developed to meet industry's need of an elastomer that can withstand the attack of hot oils, lubricants, and solvents which disintegrate or swell ordinary rubbers.

He listed the following properties of the elastomer: low swelling in aliphatic and aromatic solvents and oils; excellent serviceability in synthetic lubricants, hydraulic fluids, and other high-boiling liqiuds at temperatures from zero to 400° F.; good resistance to oxidation by air, pure oxygen, ozone, or fuming nitric acid; and stress-strain properties adequate for most applications.

The elastomer is a high molecular weight, white, thermoplastic polymer of 1,1-dihydroperfluorobutylacrylate containing 52% fluorine and having a specific gravity of 1.54. It is also available in a stable, translucent latex containing 30% rubber solids. Conventional techniques and standard equipment can be used for 1F4.

The reinforced, polyamine-cured vulcanizate has properties which are applicable for such products as O-rings and gaskets, wire braided hose for high-temperature and high-pressure use, solvent pump components, printer rolls, industrial rolls, solvent-resistant printing plates for paper, mountings for transformers and acoustical pick-up equipment, and as a permanent solvent-resistant plasticizer.

Mr. Talcott, describing Silastic LS-53,[1] a fluorosilicone rubber, said that its extreme low-temperature flexibility, combined with solvent and high-temperature resistance, indicate that it will be useful for sealing against solvents, lubricating oils, hydraulic fluids, silicone fluids, and other materials where the extremes of temperature are encountered.

[1] RUBBER WORLD, May, 1957, p. 234.

Rubber Research Traced By Morton in Chicago Talk

"A Century of Rubber Research" was the title of a talk given by Maurice Morton, director of the Institute of Rubber Research at the University of Akron, before 165 members of the Chicago Rubber Group at the Furniture Club, Chicago, Ill., April 26.

Dr. Morton traced the achievements of rubber researchers from the independent discovery of vulcanization by Goodyear and Hancock around 1840 to the recent successful duplication of the molecular structure of *Hevea* rubber.

Actually, the first chemical knowledge of rubber began with Greville Williams, who in 1860 isolated and identified isoprene from the pyrolysis of rubber. Williams and others subsequently found that the reverse reaction, polymerization of isoprene, never yielded the natural product.

In 1902, Weber postulated *Hevea* as a polyprene consisting of groups of isoprene units. Twenty years later Staudinger suggested the existence of a rubber macromolecule, consisting of a long-chain polyisoprene, but it was largely the X-ray work of Mark and Meyer in 1928 that finally shed light on the duplication of the natural rubber molecule.

Their discovery of the *cis-trans* specificity in *Hevea* and gutta percha led to the only plausible explanation of the difference between natural rubber and the synthetic polyisoprenes, which were copolymers of all possible structures.

The introduction of infrared spectroscopy techniques to the field of polymers during the last 10 or 15 years finally led to the understanding of the value of lithium and the Ziegler catalyst in controlling the chain sructure of polyisoprene.

Twenty-four graduates of the Group's 1957 course in basic compounding of rubber were awarded diplomas during a post-dinner ceremony. All represented rubber manufacturers in the Chicago area. Mystik Adhesive Products had three graduates. Bauer & Black Co., Dike-O-Seal, Inc., L. M. Bickett Co., and Roth Rubber Co. had two graduates apiece.

Each of the following firms had one graduate: Chicago Allis Mfg. Corp., Victor Gasket & Mfg. Co., Dryden Rubber Division of Sheller Mfg. Co., Lavelle Rubber Co., Richardson Co., Lanair Co., Brummer Seal Corp., Sam'l Bingham & Son, Western Felt Works, Chicago Rawhide Mfg. Corp., Rainfair, Inc., Felt Products Co., and Phoenix Mfg. Co.

Vince LaBrecque, Victor Gasket, was elected president for the 1957-58 term; while Maurice J. O'Connor, O'Connor & Co., Inc., was chosen vice president. John Groot, Dryden Rubber, was elected secretary, and Stanley Choate, Tumpeer Chemical Co., was elected treasurer. Selected for the board of directors were J. Moore, Roth Rubber; H. D. Shetler, Chicago Rawhide; Ed Wagner, Witco Chemical Co.; and John Porter, H. Muehlstein & Co., Inc. J. Stonis, C. P. Hall Co., is chairman of the election committee.

Joint Engineering Confab

The Canada-U.S. Chemical Engineering Conference, sponsored jointly by the American Institute of Chemical Engineers and The Chemical Institute of Canada, Chemical Engineering Division, will be held in Montreal, P.Q., Canada, April 20-23, 1958.

Symposia on the following topics are being arranged: fluid mechanics, chemical engineering methods in mineral processing, hazards in the chemical industry, future sources of energy, modern chemical plant construction techniques, new approaches for commercial chemical development, and chemical engineering technology in the pulp and paper industry.

Papers for possible presentation at the Conference should be submitted to the chairman of the Canadian program committee, Dr. W. H. Gauvin, McGill University, Montreal, P.Q., Canada.

NEWS of the MONTH

Washington Report and National News Summary

. . . The U. S. Department of Justice has instituted a suit against The B. F. Goodrich Co. for a royalty-free license and all information about that company's process for making synthetic polyisoprene. Goodrich flatly denied that its research contract with the government covered the synthetic polyisoprene development.

. . . Disposal of the Government's Rubber Laboratory in Akron, O., is now up to the Budget Bureau, with Firestone Tire & Rubber Co.'s bid of $760,000 likely to receive real consideration.

. . . The Rubber Industry Advisory Committee of the General Services Administration has been described to the Congress as an "excellent example of how helpful such a group can be."

. . . The final report by the Department of Commerce on the 1954 Census of Manufactures for the rubber industry shows California, Michigan, and Massachusetts about equal in rubber consumption and second only to Ohio.

. . . Industry leaders and investment analysts continue to see rubber industry growth likely to exceed that projected for the general economy.

. . . The International Rubber Study Group meeting in Indonesia in June should provide maximum opportunity for interchange of views between producers and consumers on the producers' home grounds.

. . . U. S. Comptroller General Campbell takes dim view of Welsh alcohol butadiene plan. Points out previously demonstrated economic unfeasibility and reversal of government's synthetic rubber policy.

Washington Report

By ROBERT E. L. ADAMSON

Justice Department Sues Goodrich-Gulf Chemicals; Says 1949-55 Research Contract Covers Ameripol SN

The Department of Justice took The B. F. Goodrich Co. into court in May in an effort to wrest away from Goodrich-Gulf Chemicals, Inc., its secret process for duplicating the natural rubber molecule —Ameripol SN rubber. In following through on a long-standing threat to sue Goodrich, the government said it was entitled to a royalty-free license on the process which it would make available to the entire rubber industry.

Goodrich-Gulf Patent

The process was developed and is patented by Goodrich-Gulf Chemicals, an equally owned subsidiary of Goodrich and Gulf Oil Corp. Goodrich had a synthetic rubber research and development contract with the government under which it agreed, according to the government, to turn over all information developed by it "or its subsidiaries, regardless of whether such information resulted from research paid for by the government." The contract, originated in 1949 and expired in 1955, also provided for the grant of royalty-free licenses to the government and permission for disclosure to the public.

Goodrich Statement

Goodrich flatly denied that its contract with the government, in which Goodrich-Gulf Chemicals was not named, covered the synthetic rubber accomplishment. The company contended:

"The discovery of Ameripol SN rubber was a development of Goodrich-Gulf Chemicals and bore no relationship whatsoever to a research contract between the B. F. Goodrich Co. and the government. Goodrich-Gulf is owned 50% by Gulf Oil Corp. and 50% by B. F. Goodrich.

"The discovery which the government now seeks to take away from B. F. Goodrich was based upon scientific knowledge purchased by Goodrich-Gulf in Europe in 1954. . . . it appears . . . that the government is claiming that we should give this discovery by Goodrich-Gulf Chemicals to our competitors and the government without compensation.

"It appears . . . that the government is claiming that B. F. Goodrich duplicated the natural rubber molecule while the company had a research contract with the government. It should be emphasized that although the government does not claim that government funds were used in the development of SN rubber, it contends nevertheless that B. F. Goodrich should give this development to its competitors and to the government. . . .

"The discovery was made with private funds of Goodrich-Gulf Chemicals, not by B. F. Goodrich, and SN rubber is the property of Goodrich-Gulf Chemicals. There is no justification whatsoever for the government's claim."

Though the above was the extent of Goodrich's immediate answer, a formal answer to the suit was expected to be more specific on the Goodrich position and its reasons for denying the process to the government. The suit was filed in the Federal District Court for the District of Columbia; under normal procedure, the company has 100 days to reply.

Contract Provisions

The lengthy suit filed by the Justice Department included a copy of the original contract between Goodrich and the government, dated July 1, 1949, together with the agreements extending the contract on a year-to-year basis through June 30, 1955. Pertinent provisions of the contract, as well as an important amendment of April 6, 1950, read as follows:

"The fundamental research work to be conducted hereunder shall be directed to the extension of knowledge of the general principles governing the preparation of rubber-like polymers of butadiene and/or its hydrocarbon homologs, and rubber-like copolymers, mixed polymers and interpolymers of butadiene and/or its hydrocarbon homologs with styrene and/or substituted styrenes; the content of butadiene and/or its homologs being within the range of 50% to 100% by weight of the rubber hydrocarbon present. . . .

"The applied and developmental research work to be conducted . . . shall be directed to the determination of generally accepted principles for, and to the adaptation of such principles to techniques for, the production of rubber-like polymers of butadiene, and of rubber-like copolymers, mixed polymers and interpolymers of butadiene with styrene; the content of butadiene being within the range of 50 to 100% by weight of the rubber hydrocarbon present. . . .

"Your company (Goodrich) shall promptly report and make fully available to (the government) or its nominees all information within the scope . . . of the research conducted for (the government), acquired from any source or developed during the term of this agreement by your company or its subsidiaries and affiliates (companies in which your company now has, or may in the future acquire, directly or indirectly, 50% or more of the stock having the right to vote for directors). . . .

"In addition to the information submitted under (the monthly progress report requirement), your company shall make available to (the government) or its nominees, to the extent and whenever requested, all information in the possession of your company or its subsidiaries and affiliates during the term of this agreement, which is outside the scope of the research conducted for (the government) hereunder, but which is necessary in connection with the utilization of the information so submitted in the production or use of rubber-like polymers, copolymers, mixed polymers and interpolymers of the composition (already) defined; whether or not any of such information results from work the cost of which is reimbursed by (the government) or whether it is patented, patentable or unpatentable; but such additional information specifically shall exclude that pertaining to subsequent compounding of synthetic rubber, its latices and masterbatches, or pertaining to the preparation of butadiene, styrene, isoprene, vinyl monomers, and of other raw materials, or pertaining to the preparation of accelerators, antioxidants, catalysts, extenders, plasticizers, carbon or lampblack, and any other agents for use in the aforesaid production or use. . . .

"(1950 amendment) The applied and developmental research work to be conducted . . . shall be directed to the determination of generally accepted principles for, and to the adaptation of such principles to techniques for, the production of rubber-like polymers of butadiene, and of rubber-like copolymers, mixed polymers and interpolymers of butadiene and/or its hydrocarbon homologs with styrene; the content of butadiene and/or its homologs being within the range of 50 to 100% by weight of the rubber hydrocarbon present. . . ."

FFC and NSF Actions

In the sequence of events leading up to the suit, it is necessary to note that the original contract was signed for the government by the now-defunct Reconstruction Finance Corp., transferred to its successor on synthetic rubber, Federal Facilities Corp., in 1954, and transferred again to FFC's successor on synthetic rubber, the National Science Foundation, in 1955.

The FFC and the NSF, according to the suit, both unsuccessfully attempted to secure "all information" on the process from Goodrich. As the suit points out, Goodrich-Gulf Chemicals "acquired information about the synthesis of or succeeded in synthesizing a *cis*-1, 4-polymer of isoprene (a hydrocarbon homolog of butadiene)" on or before December 2, 1954.

The abortive government attempts to acquire the process were made on December 10, 1954, February 10 and June 22, 1955, and October 24, 1956. In December, 1954, and April, 1955, according to the suit, Goodrich filed the process in the United States for patents; Goodrich-Gulf filed and obtained a Belgian patent in June, 1956.

"The scope of the research conducted by defendant (Goodrich) for plaintiff (government)," the Justice Department told the Court, "included research pertaining to the preparation of rubber-like polymers of butadiene and its hydrocarbon homologs and thus included said synthesis inasmuch as a *cis*-1, 4-polymer of isoprene is the main constituent in natural rubber, and isoprene is a hydrocarbon homolog of butadiene."

Over the six-year span of the Goodrich-Government arrangement, the company's research activity was categorized into fundamental, applied, and developmental. Through June 30, 1952, expenditures under the agreement totaled $152,500 for fundamental research, $323,900 for applied, and $474,000 for developmental. During the final three years, when applied and developmental were lumped together from a budgetary standpoint, the bill came to $120,000 for fundamental research, and $545,000 for applied and developmental.

Government Objectives

The government seeks a declaration by the District Court that it is entitled to receive from Goodrich all information about the process and a royalty-free license to use the information. The government also seeks a Court order directing Goodrich to deliver all information about the process.

With four government attempts at getting the process out-of-court already rejected by the company, it was obvious that either party was prepared to take the case all the way to the Supreme Court —a long process—for a final judgment.

Farm Surplus Alcohol Butadiene Plan Discouraged; Comptroller General Sees No Need of New Activity

Uncle Sam's no-nonsense auditor, Comptroller General Joseph Campbell, threw the second bucket of cold water in as many months on the proposal to inaugurate a huge surplus-grain consumption program to manufacture alcohol butadiene. In a jaundiced-eye letter to the Senate Banking Committee in May, Mr. Campbell said he viewed the program as something less than absolutely necessary in view of the long history of alcohol butadiene production dating back to World War II.

Senate Bill 1741

The new plan, proposed by a special presidential committee headed by Nebraskan J. Leroy Welsh,[1] has been incorporated in a Senate bill (S. 1741) introduced jointly by Sen. Paul Douglas, Illinois Democrat, and Sen. Carl Curtis, Nebraska Republican, both members of the farm bloc. They thought enough of the idea not only to sponsor a bill, but also to shelve the House-approved bill to permit sale of the government's alcohol butadiene plant at Louisville. Since the plan envisions employment of the Louisville facility, as well as another alcohol butadiene plant in private hands at Kobuta, Pa., and 10 privately owned alcohol plants, the Senators felt they should not permit the Federal Facilities Corp. to unload Louisville until some decision has been reached on the Welsh proposal.

At this point, then, there is little likelihood of Congressional action this year on the Louisville sale. Moreover, the chances of early consideration of the Welsh program have also dimmed considerably. With a very heavy schedule of "must" legislation before it, the Senate Banking Committee was not expected to get an opportunity to hold hearings on the alcohol butadiene program before the Fourth of July. At that date the temptation would be, under the press of mid-summer adjournment, to let the whole thing slide until after adjournment or until Congress reconvenes in January.

Campbell Comments

Comptroller General Campbell was the first Administration official to comment on the Welsh Commission idea. Whether he set the tenor of other agency comments remains to be seen, but the FFC—frustrated in its attempt to sell Louisville this year—is certain to vote against the

[1]RUBBER WORLD, May, 1957, p. 256.

scheme, and there is at least a 50-50 chance that the Department of Agriculture would also veto it. Even the Welsh Commission itself, which outlined the plan to Congress, was unable to give it formal endorsement.

As modified by the Douglas-Curtis bill, the scheme would authorize the President, or any agency designated by him, to take over both the Louisville plant and a government-owned alcohol plant at Omaha, Neb., and to buy, build, purchase, or lease whatever facilities may be necessary "to conduct an experimental program for manufacturing butadiene from alcohol produced from agricultural products, for the purpose of demonstrating the commercial feasibility and ascertaining the costs of such production." As noted by the commission, 10 privately owned alcohol plants stand idle now and would be available to feed the butadiene plant at Louisville and another at Kobuta, also idle.

The Kobuta plant was sold to Koppers, Inc., but is subject to re-acquisition by the government.

Campbell said the commercial feasibility of producing butadiene from both alcohol and petroleum was proved out under the synthetic rubber program created in World War II. The government, he reminded the Senate Banking Committee, kept its records of production costs for each of the two basic feed materials.

"These costs indicate that butadiene was produced from alcohol at substantially greater costs than that produced from petroleum," he pointed out. "In the light of this background, your committee may wish to consider whether a new experimental program for that purpose is necessary."

Continuing in this tone of understatement for which the Comptroller General is traditionally noted, Campbell said the scheme would "seem to deviate" from the recent government policy of withdrawing from synthetic rubber production in favor of private industry. It is clear that adoption of the plan would put the government back into the business in a big way—an estimated 180,000 tons of butadiene annually. The Welsh Commission outline of the plan, however, said the government's production could readily be absorbed by the expanding synthetic rubber, plastics, and paint markets.

This idea is not expected to be received favorably by the rubber and petroleum industries when the Douglas-Curtis bill comes up for consideration.

GSA's Rubber Industry Advisory Committee Lauded; Called Excellent Example of Value of Such Groups

The 18-man Rubber Industry Advisory Committee to the General Services Administration was held up to the House Government Operations Committee in May as an "excellent" example of how helpful an industry advisory body can be. Strangely enough, the Rubber Committee earned its kudos from Congress by its sharp split of last fall over the need of setting up a change in the government stockpile rotation system to meet possible rubber shortages stemming from the Suez crisis.[1]

Since the House Committee probing the advisory committee system seemed to be concerned chiefly with whether the advisers were cooperating among themselves to give the government advice contrary to the public interest, the bitter division of the Rubber Committee on a vital stockpiling question gave the House unit confidence in the committee's earnestness and trustworthiness.

Committee Record Cited

Thus, the legislators led the Rubber Committee's chief government sponsors, E. H. (Buck) Weaver, chief of the Defense Materials Services, GSA, and George Casto, director of GSA's Agricultural Division, through the whole "case" history of the Rubber Committee since its inception during the Korean War. What Weaver and Casto spread on the record is a well-documented account of how the government faced problems singular to the rubber industry and how it relied on a bevy of unsung industry officials for information and cooperation only industry people could develop.

At last count, the membership of the Rubber Committee—with one seat unfilled—included eight representatives of the manufacturing segment of the industry and nine from the trading segment. They are (manufacturing): E. R. Gibson, Seiberling Rubber Co.; J. C. Roberts, Firestone Tire & Rubber; H. Van Valkenburgh, Dunlop Tire & Rubber Corp.; C. J. Zabick, General Tire & Rubber Co.; R. B Bogardus, Goodyear Tire & Rubber Co.; J. T. Adams, Sears Roebuck Co.; Ralph Au, B. F. Goodrich Co.; and E. W. Kane, American Hard Rubber Co.

Representing rubber trading interests are: J. F. Frank, of Jacobus F. Frank; R. Badenhop, Robert Badenhop Corp.; S. J. Pike, S. J. Pike & Co., Inc.; R. D. Reilly, Imperial Commodities Corp.; D. H. Olson, Avia Corp.; F. T. Koyle, Carl M. Loeb, Rhoades & Co.; D. A. Patterson, H. A. Astlett & Co., Inc.; J. Louis, Littlejohn & Co.; and S. E. Brennan, H. Muehlstein & Co., Inc.

The Committee came into existence in 1951 when the government took over rubber distribution and felt it should establish working contact with the industry in the best interests of equitable and efficient treatment. This Committee has remained active since the Korean War crisis, Casto told the House unit; it w s important to the government, because of its huge stockpile of natural rubber, to know the approximate rate at which it can replace low-grade and stale rubber "without interfering with the producers in the Far East or with the consuming industry in the United States."

He said GSA did not want to get too much rubber into the market at one time because this would soften the price and lower GSA's return to the taxpayer. Defense Materials Chief Weaver, Casto explained, makes the final decisions on when and how much rubber to move into the domestic market. Under this system, he continued, the government's only loss has been deterioration.

Committee Advice Secret

When several House committee members indicated it might be wise to file the meeting agenda and minutes of any Rubber Committee meeting with Congress immediately after every get-together, Casto rejected the idea as contrary to the government's best interests.

"The rubber market," he pointed out, "fluctuates rather violently each day, and is subject to bullish (upward) and bearish (downward) forces. We have found in our experience that any time GSA makes any announcement regarding what it is doing insofar as stockpiling of rubber is concerned, we either have a bearish effect on the market or a bullish effect on the market.

"And if we have no effect whatsoever—then the price goes up or down—we get condemned because this has happened. This is the only objection we have to making public the minutes of our meeting. . . ."

Casto made it clear, however, that he would have no objection to releasing the minutes well after a particular action discussed at a meeting has been taken. He suggested a wait of six months would be reasonable to protect GSA and to keep information from being used against the public interest. This would have the effect of postponing disclosure of Rubber Committee recommendations to GSA for a full six months after they are tendered to GSA.

"We hold an Advisory Committee meeting in order to develop maximum possible information that we can secure, not necessarily to receive advice from them as to what we should do, but as to the quantity of a grade of rubber that the Committee feels could be consumed without disrupting markets or the total market, or the amount of a grade of rubber that is being consumed monthly in the United States.

"As the price of natural goes up, consumption swings toward synthetic rubber, and as the price comes down, it swings back toward natural rubber. The problem is what grades they (industry) are using and in what quantities."

Weaver, Casto's superior on rubber, readily conceded under questioning by House Committee Counsel Orville J. Montgomery that the advice and recommendations of the Rubber Advisory Committee are sometimes colored by the private interests of those making the recommendations.

"I think that is just human," Weaver said, "but I think that in the construction of this Committee we have opposing forces, and when we listen to all sides of the story, then we try to come to conclusions out of that."

He agreed that GSA was in a better position to evaluate Committee advice when meetings are "full and complete" and when there is "a difference of opinion."

[1]Rubber World, Nov., 1956, p. 279.

This was just about what happened last fall when the manufacturing interests within the advisory group—opposed by the traders—proposed that GSA stand by to make more stockpile available if the Suez blockade brought a temporary shortage, and to permit longer periods to replace the rubber purchased under the larger selling program.

Weaver and Casto warned the Government Operations Committee against requiring minutes of advisory meetings—if they are released—to show the names of persons making recommendations or tendering advice. The GSA duo also said they had no objection to submitting meeting minutes to the Justice Department and the General Accounting Office immediately —without the six-month waiting period suggested for public release.

"Shining Example"

A spokesman for the Government Operations unit said this airing of the Rubber Committee's activities showed it was a "shining example" of how the government stood to gain when the advisory committee program was properly conducted.

Akron Laboratory Disposal Now Awaits Budget Bureau

GSA, moving quickly after a slow start, cleaned up its disposal duties on the Akron, O., rubber laboratories in May and prepared to turn the whole problem over to the Bureau of the Budget, right arm of the President on matters legislative and fiscal. The combined laboratories/pilot plant facilities were put on the block by GSA's Chicago office in newspapers published during the week April 22-26.

No Negotiation

Return bids were due May 23. In a surprise development, GSA decided against its normal disposal procedure of accepting all bids for negotiation during the 30-60-day period after public bid opening. GSA officials declined to explain this departure from the norm, but presumably decided on this procedure on advice from the Budget Bureau and because the disposal law for the Akron facility does not specifically call for negotiations with private bidders.

Under the unique language of the law, GSA was required to canvas all other government agencies having a possible interest or use in Akron, including those with an interest other than that for which the facility was originally constructed—research and development. The Congressional mandate directed GSA merely to survey governmental interest—not to turn it over to that agency most interested, as is the case with most disposals handled by GSA.

Budget Bureau Decision

This puts Budget Director Percival Brundage in a position almost without precedent—he must weigh the best government bid (from the Department of Agriculture) against the best non-government bid and decide which is in the best interest of the government to accept. It was at the bidding of Secretary of Agriculture Ezra Taft Benson that this disposal procedure was established. He advised the Senate Banking Committee, where the idea was put into the legislation, that the Akron set-up might be useful to the program for finding new uses for farm products. He suggested, however, that private industry might offer enough for all or part of the facility to finance new, specially designed laboratories for food research.

At any rate, GSA, in continuing communication with the Budget Bureau during its Akron disposal activities, is studying the private bids preparatory to turning one or all of them over to Brundage for comparison with the Benson bid and for a final decision on whether Akron should be turned over to private industry. GSA said it will conduct a preliminary review of the Akron portfolio first, but that Brundage will have the last word.

Akron was built during 1943 for research in connection with the huge synthetic rubber program of World War II. Standing idle since June of last year, it was operated for 13 years by the University of Akron under government contract. The government offered a free one-year lease to Akron, commencing July 1, 1956, but the University's trustees decided they could not handle the almost $1 million in operational expenses and rejected the offer. They turned the facility back to the government on July 1, and GSA has maintained it in standby condition, preparatory to assigning it to another agency or selling it to private interests.

Three return bids received by GSA, May 23, were led by Firestone Tire & Rubber Co., which owns property on two sides of the facility in Akron. Firestone's bid was $760,000. Other bidders were Thiokol Chemical Corp., Trenton, at $251,278, and Robert G. Dunlap, at V. L. Smithers Laboratories, Akron, $245,-000.

Rubber Study Group June Meeting in Indonesia

The thirteenth annual meeting of the International Rubber Study Group will be held in Djocjakarta, Indonesia, from June 24-28. The publication of the National Rubber Bureau in Washington, D. C., *Natural Rubber News,* in its May issue points out that for the first time the Rubber Study Group will gather in the natural rubber producing area. The meeting will provide an opportunity to contact on home ground the political and business personalities of the world's largest suppliers of natural rubber, i.e., Indonesia and Malaya.

Politically, internally, and economically, Indonesia is at the crossroads, and for all these reasons the Rubber Study Group meeting deserves to be well supported by a strong United States delegation, it was said.

Indonesia's rubber industry itself is at a direct crossroads. How much faith the government places in the future of natural rubber will determine the degree to which encouragement is given to native rubber replanting, to increasing yields by a soundly conceived government program in the smallholder areas, and to making more attractive to private capital, investment in large-scale estate replanting, *Natural Rubber News* pointed out.

Also, in the early Fall of 1957, Malaya will become an independent country, and the views of the Malayan delegation about the future of natural rubber from that area after independence should be of real significance.

A disturbing factor overhanging the agenda of this meeting, however, is the inclusion of study of a possible commodity agreement as a subject for discussion. The opposition of both United States Government and industry leaders to an international rubber agreement is too well known in detail, and this is not the time to divide Rubber Study Group delegates with an obviously impossible issue on which to secure agreement, it was emphasized in the Natural Rubber Bureau *News.*

National News

Final 1954 Census of Manufactures Figures Reveal Some Interesting Production and Consumption Trends

The consolidated report on the 1954 Census of Manufactures was recently released by the United States Department of Commerce, Bureau of Census, as Bulletin MC-30A. This bulletin on rubber products provides detailed information on the production of tires and inner tubes, rubber footwear, reclaimed rubber, and rubber products, not elsewhere classified, and many subdivisions of these major product classifications. Included is information on employment, wages, volume of production, and value for a wide range of goods produced by the industry.

The Rubber Manufacturers Association, Inc., has called attention to the fact that the figures on rubber consumption in this bulletin show that although Ohio remains the largest single consumer of rubber, an amazingly close race for second place

TABLE 1. PRODUCTION, SHIPMENTS, AND VALUE OF CERTAIN RUBBER PRODUCTS, 1954 COMPARED WITH 1947

Product	1954 Production	1954 Shipment	1954 Value $1,000	1947 Production	1947 Shipment	1947 Value $1,000
Passenger tires, 1,000's	77,229	76,712	853,635	77,891	75,787	670,039
Truck and bus tires, 1,000's	12,476	12,552	520,169	17,622	17,172	536,708
Inner tubes, pass., 1,000's	50,712	52,090	74,118	66,514	65,878	90,608
Inner tubes, truck, 1,000's	8,969	9,208	31,328	14,573	14,066	41,776
Footwear, canvas, 1,000 prs.	51,107	50,944	99,220	23,603	22,921	38,481
Footwear, waterproof, 1,000 prs.	23,134	24,817	64,510	57,454	56,437	120,709
Heels, doz. prs.	21,114,596	21,094,496	31,907	26,696,276	26,468,574	31,028
Soles, doz. prs.	12,133,927	12,121,192	48,242	9,996,364	9,778,549	31,231
Slabs and sheets, 1,000 sq. ft.	115,313	115,568	32,939	48,817	48,755	9,916
Belts, conv. & elev., 1,000 lbs.	48,256	48,039	40,631	56,649	56,152	37,195
Flat transmission, 1,000 lbs.	10,631	10,516	14,593	30,019	29,460	26,132
Latex foam, auto seat and uphost. only, 1,000 lbs.	104,311	105,259	86,575	19,113	18,587	18,914
Blown sponge, 1,000 lbs.	66,975	66,383	30,230	44,274	41,988	19,962
Gloves, house & surg., doz. prs.	2,814,336	2,674,163	11,086	1,815,881	1,769,566	4,466
Cement, 1,000 gals.	39,990	39,984	54,542	n.a.	17,650	20,982

took place among California, Michigan, and Massachusetts, in 1954.

The 1954 consumption by geographical areas was reported as follows, in long tons: New England, 174,647; Middle Atlantic, 163,398; East North Central, 600,436; West North Central, 75,289; South Atlantic, 57,431; East South Central, 129,-894; West South Central, 58,429; and West, 147,301.

Consumption figures (in long tons) for the states listed follow: Ohio, 358,962; California, 126,573; Michigan, 121,512; Massachusetts, 115,611; Pennsylvania, 93,-916; Alabama, 69,613; Indiana, 54,521; Tennessee, 42,278; Wisconsin, 43,564; Connecticut, 40,652; Iowa, 39,424; Maryland, 39,263; New York, 37,893; New Jersey, 31,589; Kansas, 30,758; Illinois, 21,977; Rhode Island, 10,556; Virginia, 5,418; Georgia, 4,508; Missouri, 3,387; and New Hampshire, 2,147.

It is to be remembered that the year 1954 was not particularly representative of the 1950's for production in any manufacturing industry. Comparisons between figures for 1954 and the previous Census of Manufacturers in 1947 must be viewed with caution. A few such comparisons of production, where these figures may be considered directly comparable, are given in Table 1, however, as an indication of trend. Shipments and value, particularly the latter, are influenced by different conditions existing in 1954.

In connection with the figures in Table 1, the effect of the tubeless tire, even in 1954, is quite evident. The effect of plastic footwear probably accounts for considerable drop between 1947 and 1954 of the production in this category. The greater demand for soling slabs and toplift sheets is shown by the more than 100% increase in demand for this material in 1954.

The spectacular growth of the demand for foam cushioning between 1947 and 1954 is indicated by the fivefold increase in the production of this material, even though these figures are limited to those for auto seating and upholstery. Rubber gloves and rubber cement show also a nice increase in output and shipments.

Industry Still Optimistic Over '57 Output and Sales

Although overall industrial production fell a little more than seasonally from declines in automobile and other durable goods production and lower steel output, and rubber industry production as measured by consumption of new rubber was down about 8%, the outlook for 1957 as a whole appeared good to most industry leaders.

Chester J. Noonan, United States Rubber Co. vice president, declared in May that his company expects a strong final quarter to help lift sales to a new record of $950 million. Increased original-equipment tire sales after the 1958-model automobiles are placed on the market and increased use of rubber footwear and industrial rubber products are also expected to add to the sales gain.

Rubber industry sales are expected to hit the $6-billion mark in 1957, as compared with $5.4 billion in 1956. The general price level for rubber products should be somewhat higher during the year, reflecting higher costs for both labor and raw materials, it was added.

At a sales meeting of the Foamex Division, Firestone Industrial Products Co., in mid-May, sales of Firestone's foam rubber products were said to be running ahead of those for the first half of last year, in spite of heavy competition.

Cooper Tire & Rubber Co. has reported lower profits expected for the first half of this year on about the same volume of business as in the first half of 1956. This company, however, looks for new machinery, recently installed, to improve profits in the second half of 1957.

Estimated capital and investment expenditures amounting to approximately $41 million, an increase of 10% over 1955 expenditures, are planned by The B. F. Goodrich Co. in 1957, Board Chairman John L. Collyer told company stockholders in late April. Mr. Collyer said this year's capital and investment expenditures are part of a $200-million five-year program begun by his company last year.

William O'Neil, president, The General Tire & Rubber Co., announced in May that in order to keep pace with General Tire's expanded volume of business, additional capital is desirable, and forward planning calls for some financing. He said the new financings were desirable "to maintain our projected growth pattern in the several areas of our business."

Mr. O'Neil emphasized that General Tire has no intention of selling off any of its holdings in Aerojet-General, its rocket-producing subsidiary, "for capital gains or any other purposes." He added that General was thinking of a total program in the neighborhood of $25 million in the two companies combined.

Standard & Poor's, New York investment analysts, in its latest report of May 9, emphasizes the growth aspects of the rubber fabricating industry. This report states that the rubber fabricating industry's future growth appears likely to exceed that projected for the general economy. Longer-lived tires may hold this business, once the mainstay of the rubber industry, short of expected gains in population and in the number and use of motor vehicles, but the trend toward broadening activities shows no signs of abatement.

In addition to enhancing growth potentialities, lessened dependence upon tire business will be important profitwise. Tire volume will continue highly sensitive to intermediate fluctuations in general business conditions, and the effect of lower shipments on earnings will likely be aggravated by the recurrent price wars characteristic of this intensely competitive field, the report added. The existence of the domestic rubber industry was mentioned as contributing greatly to stability of operations.

Tariff Commission Reports 1956 Synthetic Up 11%

According to a United States Tariff Commission report released in late May, preliminary statistics on the production and sales in 1956 of synthetic rubbers showed total domestic output of all types amounted to 2,314 million pounds (1,033,-035 long tons), an increase of 11% over the output of 2,083 million pounds (930,-000 long tons) in 1955. Sales of synthetic rubbers in 1956 amounted to 2,156 million pounds (962,500 long tons), valued at $588 million, compared with 2,069 million pounds (923,661 long tons), valued at $573 million in 1955.

The production of cyclic elastomers, consisting almost entirely of SBR amounted to 1,808 million pounds (807,143 long tons) in 1956, compared with 1,643 million pounds (733,482 long tons) in 1955. Sales of SBR amounted to 1,680 million pounds (750,000 long tons), valued at $403 million in 1956, compared with 1,644 million pounds (733,930 long tons) valued at $402 million in the previous year.

Production of acrylic elastomers, consisting of neoprene, butyl, silicone, isobutylene, and other types, amounted to 506 million pounds (226,000 long tons) in 1956, compared with 440 million pounds (196,430 long tons) in 1955. Sales amounted to 476 million pounds (212,500 long tons), valued at $185 million in 1956,

compared with 425 million pounds (189,-732 long tons), valued at $170 million in 1955. Neoprene production in 1956 amounted to 223 million pounds (99,553 long tons); butyl production was 166 million pounds (74,100 long tons); and nitrile rubber production was 76.3 million pounds (34,053 long tons).

No vinyl elastomers were covered in this report, in contrast to previous reports.

rent annual production of 6.2 million passenger cars, rubber consumption in 1960 at 1.7 million tons is predicated on 10 million passenger cars being made in that year. Consumption of rubber for non-tire products is now about equal to that for tires, and with the growing use of rubber air springs non-tire use may well exceed tire use in the near future.

The potential use of synthetic rubbers outside the United States, as foreign countries increase their per capita consumption, will add to the total world demand. Since natural rubber production will remain at its present level for several years, this increased demand must be met by synthetic rubbers.

Mr. Thomas expressed his appreciation for the cooperation in connection with the expansion completed by Petro-Tex, timed to coincide with the Goodyear expansion.

P. L. Davies, president of Petro-Tex and of Food Machinery, was introduced and said his company was glad of the opportunity of working with Goodyear and considered this a valuable asset.

J. D. D'Ianni, assistant to the vice president for research and development at Goodyear, discussed the present-day position of synthetic rubber. He said that last year this country met 61% of its total new rubber requirements with synthetic rubber. In the rest of the world the percentage of synthetic rubber consumed was only 15% of the total. Synthetic rubber will be produced in a number of other countries in substantial quantities by 1958, he added, but the demand for rubber from the United States should continue indefinitely, because our industry is firmly established on the basis of high quality and low cost.

Dr. D'Ianni said he was confident that new developments will expand the usefulness of synthetic rubbers and decrease our dependency upon natural rubber.

The chemical industry, he declared, often quotes figures on the percentage of its products which were not in the line a few years previous. The same thing can be said for the synthetic rubber industry. More than 50% of the 1956 production of polymers at Houston consisted of varieties which were not in the line in 1950. Such trends can be expected to continue in future years at an accelerated pace.

Other Industry News

Goodyear's Houston SBR Plant Expansion Completed; Thomas Stresses Growing Need of More Synthetic

The Goodyear Tire & Rubber Co. announced completion of an expansion program costing nearly $10 million which will boost the production capacity of styrene-butadiene Plioflex rubbers to 220,-000 long tons a year at its Houston, Tex. plant at a press party and plant tour in Houston on May 2.

E. J. Thomas, president of the Goodyear company, stated that: "Indications are that within a few short years worldwide demand for rubber will exceed present supplies, and we have moved to beat what could otherwise develop into an acute shortage of this vital material at runaway prices."

Simultaneously, Petro-Tex Chemical Corp., owner and operator of a butadiene plant adjacent to the Goodyear plant, announced that expanded butadiene production facilities which increased capacity from 90,000 to 200,000 tons of butadiene a year had been placed in operation on the same day.

Petro-Tex Chemical Corp. is owned jointly by Food Machinery & Chemical Corp. and the Tennessee Gas Transmission Co. Petro-Tex was formed two years ago to operate the plant when it was purchased from the government.

The two new reactor lines at the expanded Goodyear SBR plant

Goodyear Plant Details

With this capacity increase, Goodyear's Houston plant thus becomes the world's largest single producer of dry SBR, it was said. Completion of the expansion program comes just two years after purchase of this plant from the government.

Heart of the $10-million expansion was the construction of two completely new reactor lines, each containing 11 reactors of 5,000-gallon capacity each, and a new recovery area with three new stripping columns.

Also included in the expansion program are spherical butadiene blend tanks of 210,000-gallon capacity each, increased styrene storage capacity, a new materials preparation building, and a new and larger final process or finishing building containing four drying units. New gas-fired dryers were said to be the first of their kind in the SBR industry.

Warehouse space at Goodyear's Houston plant now totals more than 117,000 square feet, and more than 17 million pounds of Plioflex rubber can be stored at one time.

The continuous production method for SBR was developed in 1944 at this plant. Cold rubber production was started in 1949, as was the production of carbon black masterbatches. In 1951, the plant pioneered the production of oil-extended rubber.

During the two years since the purchase of the plant from the government, 286,417 long tons of Plioflex rubber have been produced. These include hot, cold, and oil-extended SBR's. With the expanded production facilities now on stream, a basic line of eight different types of Plioflex rubbers is being produced.

Press Conference Program

B. A. Rosinski, manager of the Houston plant, welcomed members of the press and the rubber industry to Houston and then introduced Mr. Thomas.

In his remarks Mr. Thomas emphasized the growth in consumption of new rubber since 1941, when 670,000 long tons of natural rubber were used in this country, and gave an estimate of 1957 consumption at 1½ million long tons, 62% of which will be synthetic and 38% natural.

It was also pointed out that from a current annual production of 6.2 million passenger cars, rubber consumption in 1960 ... (continued above)

The future for synthetic rubber will undoubtedly remain bright for many years because it can be made from an infinite variety of types, and as time goes on many new families of rubbers will be discovered and evaluated. Natural rubber is a natural product which cannot be changed essentially in properties.

H. R. Thies, general manager, chemical division, Goodyear, spoke next on market trends and future outlook for synthetic rubber. He explained that since it has been determined that cold SBR gives better performance in an increasing number of end-applications, production of this type has increased from 49% of the total in 1952 to 78% in 1956. Goodyear's Houston plant is equipped to convert 85% of its total production to cold SBR as the demand dictates, he added.

Oil-extended SBR is increasing in popularity and now accounts for almost 35% of total SBR production. Goodyear's new facilities provide increased capacity for this type of rubber also.

An increasing demand for lighter colored, non-staining, non-discoloring rubbers has developed over the last five years, and here again Goodyear is well equipped to supply the demand.

In today's fast moving markets, maintenance of product quality, while undoubtedly the most essential, is but the first of several necessary phases in getting and keeping satisfied customers. Adequate supply, attractive and functional packaging, rapid delivery, and prompt and efficient technical services are all important services which the customer demands and has a right to expect, Mr. Thies said.

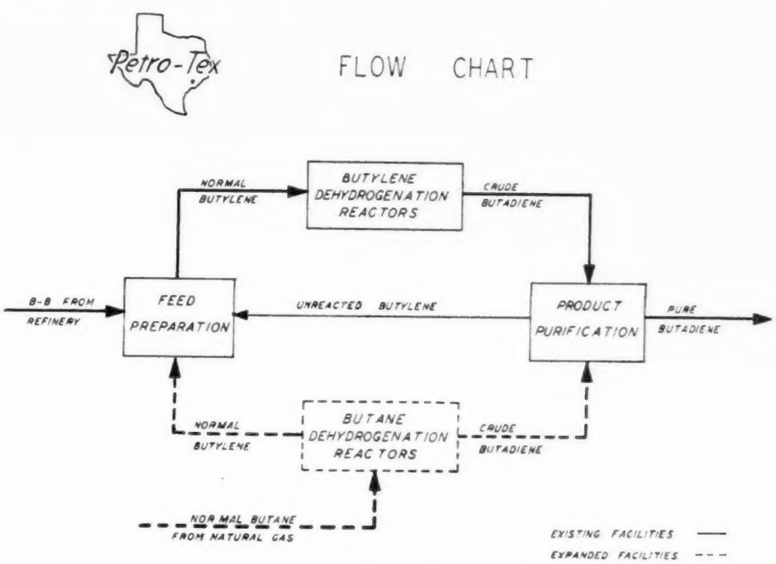
Forward projections indicate that before many years the demand for SBR in the United States will exceed one million tons a year or 2½ billion pounds, this speaker concluded.

Petro-Tex Plant Details

The original government butadiene plant purchased by Petro-Tex used refinery butylene as feedstock. The new units added include a Houdry butane dehydrogenation unit which allows the production of a substantial part of the butylene feedstock butane plus adding to the butadiene production capacity. Heart of the Houdry process at Petro-Tex is a group of 14 large cylindrical reactors—seven per unit—which contain the catalyst for converting normal butane to normal butylene and butadiene.

The final step in the process is the recovery of specification butadiene from the mixture of butadiene and unreacted butylenes produced in the dehydrogenation unit. The recovery of the butadiene is effected by a fractionating tower, extractive distillation tower, and a final butadiene fractionating tower.

The accompanying flow chart provides a rather good explanation of the old and new Petro-Tex facilities and their relation to each other in the present plant.



Flow chart showing original and new units at Petro-Tex butadiene plant

Cotton Use Upswing Seen for Automobile Interiors

Automobile manufacturers anticipate the increased use of cotton in some parts of car interiors, according to a survey made by the United States Department of Agriculture, Washington, D. C.

Cotton consumption for interior sidewalls is expected to rise because of the trend toward more extensive use of cotton-backed vinyl. The commodity is also expected to hold its own at least in the manufacture of visible interior trim, with a possibility of a slight increase in the immediate future.

For upholstery, even if nylon blends replace to some extent cotton-backed vinyls, cotton is likely to be a principal filler in the nylon blends, USDA declares. In blends with other synthetics, cotton probably will be used extensively as backing.

On the other hand, cotton consumption for headlining may decrease because of replacement of 100% cotton fabrics by cotton-backed vinyls. Cotton consumption for seat padding is also expected to decrease in favor of foam rubber. Here the use of foam rubber has increased 29% since 1950; while cotton padding has fallen 14% on a relative basis, according to the USDA.

A free copy of the report, "Fabrics and Fibers for Passenger Cars: Automobile Manufacturers' Views 1955 Compared with 1950," Marketing Research Bulletin No. 152, is available from the Office of Information, United States Department of Agriculture, Washington 25, D. C.

Polyethylene Pipe Standard

A revised commercial standard on flexible polyethylene plastic pipe has been issued by the United States Department of Commerce, Washington, D. C., after review by the National Bureau of Standards and with the cooperation of the Polyethylene Pipe Standards Committee of The Society of the Plastics Industry, Inc.

Known as Revised Standard CS 197-57, Flexible Polyethylene Plastic Pipe, it calls for all polyethylene pipe to meet the specifications of the National Sanitation Foundation which require that the pipe be manufactured of virgin polyethylene and be satisfactory for potable water.

The revised standard also has as its aim "to establish on a national basis standard dimensions and certain significant quality requirements for black, flexible polyethylene plastic pipe for the information of producers, distributors and users, and to promote understanding between buyers and sellers."

Also included is a section on recommended working pressures at 73.4° F. of Series 1, 2, and 3 pipe ranging in nominal size from ½-inch to six inches.

Copies of CS 197-57 are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., at 10c a copy. Copies of the National Sanitation Foundation's "A Study of Plastic Pipe for Potable Water Supply" are available from the SPI, 250 Park Ave., New York 17, N. Y., at $1.00 a copy.

New BFG Tire Cord Unit

The B. F. Goodrich Co., Akron, O., has begun construction of a new textile processing plant on a recently purchased 20-acre tract of land in Exeter Borough, Luzerne County, Pa., about seven miles from Wilkes-Barre.

The plant will have about 80,000 square feet of floor space and a large investment in machinery and equipment, S. W. Hempstead, general manager of the company's textile division, announced. Manufacturing operations are scheduled to begin in 1958.

Rayon and nylon tire cord used by the company's five tire plants in the United States will be processed in the new plant.

Rubber Plants 22% Safer In 1956, Contest Shows

Thirty-one of the 165 American and Canadian rubber plants participating in the 1956 Safety Contest of the Rubber Section of the National Safety Council, Chicago, Ill., had no accidents during the judged 12-month period, the Council reveals.

Total number of injuries sustained during the 433,595,000 man hours worked in the 165 plants was 1.188 for a 2.74 frequency rate, representing a 22% decrease in injuries compared with the 1955 figure.

NSC divided contestants into five divisions, depending on the average monthly manhours worked, as follows: Division I, more than 400,000 manhours; Division II, 200,001-400,000 manhours; Division III, 100,001-200,000 manhours; Division IV, 50,001-100,000 manhours; and Division V, under 50,000 manhours.

Top winners in the categories and their frequency rates, were the following:

Division I: United States Rubber Co., Mishawaka Plant, 0.18; Firestone Tire & Rubber Co., Pottstown, Pa., 0.22; U. S. Rubber, Naugatuck Footwear Plant, 0.26.

Division II: U. S. Rubber, Los Angeles tire plant; Firestone, Des Moines, Iowa; Firestone, Bombay, India; The Goodyear Tire &Rubber Co., Java, all with 0.00 frequency rates.

Division III: The B. F. Goodrich Co., Akron aeronautical division, 0.00; U. S. Rubber, Washington, Ind., 0.00; Electric Hose & Rubber Co., Wilmington, Del., 0.49

Division IV: Goodrich, Clarksville Plant; American Synthetic Rubber Corp., Louisville, Ky.; U. S. Rubber, Gilmer Plant, Tacony, Pa.; Firestone, Akron synthetic division; Goodrich, Cadillac Plant, all with 0.00 frequency rates.

Division V: Goodyear Quebec-Industrial Centre #5, reclaim, and Muncie plants; Armstrong Cork Co., Kankakee, Ill.; Goodrich Riverside and Marion plants, its works laboratory, and plant 3 of its Sponge Products Division; Firestone Plastics Co., Pottstown, Pa.; Firestone Memphis, Magnolia, and Xylos Rubber Co. of California plants, and the company's Akron retread shop; Flintkote Co., Whippany plant; U. S. Rubber Reclaiming Co., Cheektowaga, N. Y.; Canadian Lastex Ltd, Montreal, P. Q., Canada; Dominion Rubber Co., Ltd., latex and reclaim division; Gates Rubber Co. of Canada, Brantford, Ont.; Lobl Mfg. Co., Middleboro, Mass.; and U. S. Rubber Sandy Hook, Conn., plant, all with 0.00 frequency rates

Drew Co. in Fiftieth Year

E. F. Drew & Co., Inc., Boonton, N. J., manufacturer of plasticizers, emulsifiers, and fatty acids for the rubber and plastics industries, among other products, is celebrating its fiftieth anniversary.

The company came into existence in 1907 as a buyer and seller of oils in East Boston, Mass. It moved to Boonton in 1917 and there expanded its refining activities. Since then it has founded its technical products, edible oils, textile chemical, power chemicals, auto products, detergents chemical, dairy, agricultural, export, catalytic chemicals, and consumer divisions.

The firm's New Jersey laboratories, organized after World War II, develop, control, manufacture, and sell products for other divisions of E. F. Drew. The products not sold directly serve as intermediates in further manufacturing procedures. Some of the Laboratories' products are surface active agents, ethylene oxide condensates, and vitamins.

Other branches of the company include the leather, marine, and marketing departments. Drew has additional plants at Ajax, Ontario, and Sao Paulo, Brazil, and branch offices in Boston, Philadelphia, Chicago, and Rio de Janeiro. The executive offices are in New York, N. Y. The company has more than 50 warehouses throughout the United States and others in Europe, Japan, Australia, the Dutch West Indies, and the Near East.

Production, Research Team Shuffled at Copo Plant

Thomas B. Crowell, production manager of the Baton Rouge, La., plant of Copolymer Rubber & Chemical Corp., has been named vice president and general manager of the plant, according to an announcement by A. K. Walton, Copolymer president.

Mr. Crowell replaces Courtland M. Hulings, executive vice president, who will retire from all but consultative functions with the company. Charles M. McKay, chief engineer in charge of maintenance and construction, becomes production manager.

Mr. Walton revealed that the company will increase its research and development activities and is starting construction of a new laboratory.

Other personnel changes at the plant were announced as follows: Irving W. Adams, Jr., assistant to the executive vice president, has been named administrative assistant to the general manager; Herbert C. Henry, production supervisor and maintenance engineer, has been advanced to chief engineer; Donald T. Norwood, production supervisor, has been appointed production superintendent over both the butadiene and rubber plants of Copolymer.

Paul G Carpenter, formerly with Phillips Petroleum Co., has been engaged as director of research and development. Appointed manager of research was J. P. McKenzie, a widely known synthetic rubber chemist. Martin Samuels, associated with The Dayton Rubber Co. before joining Copolymer, has been named manager of development.

Litzler Awarded Contract

C. A. Litzler Co., Inc., Cleveland, O., will design and build the first of two complete high-speed tire-cord fabric treating installations for Société Anonyme des Pneumatiques Dunlop, Paris, France.

According to C. A. Litzler, who handled the negotiations for the American firm of engineers and process machinery builders, the production systems will represent the most modern design concepts for high-efficiency impregnation and preparation of the whole range of tire-cord fabrics.

Fabrics for both tube-type and tubeless tires will be processed to optimum condition when the new plants of the French firm are in operation. The output will be channeled to a complete range of tires, from motorcycle size to equipment for off-the-road units.

American Viscose Develops Stronger Rayon Fiber

A new rayon staple fiber whose yarns are said to be 70% stronger when wet and 40% stronger in the dry-conditioned state than conventional rayons has been announced by American Viscose Corp., Philadelphia, Pa.

Designated Avisco XL, the fiber is expected to gain quick acceptance for such industrial applications as belting and hose, as well as in apparel and home-furnishings. Fabrics made from it have 25% more breaking strength and 33% more tear strength than cotton, according to the company.

Avisco XL has been spun at American Viscose's textile research department into yarns as fine as 60/1 with 1.5 denier, 1⁹⁄₁₆-inch staple. Because of increased extensility, the fiber is compatible with the acrylics and polyesters for blends.

Calling the fiber "the greatest improvement in rayon since its invention," Herschel H. Cudd, the company's vice president in charge of research and development, said Avisco XL has been in successful pilot-plant production for more than six months and would be supplied in limited commercial quantities for selected end-uses, including belting and hose.

The new product was announced at the corporation's annual stockholders' meeting at the Drake Hotel, Philadelphia, May 6. Fabrics woven from the fiber were shown at the meeting.

Boston, Biltrite Merged

The merger of Boston Woven Hose & Rubber Co., Boston, Mass., into American Biltrite Rubber Co., Inc., Chelsea, Mass., became effective April 25 upon the filing of documents in Massachusetts and Delaware, it was announced by Maurice J. Bernstein, president of American Biltrite.

Stockholders of the two companies voted approval of the merger at special meetings held on April 24. The Boston firm will henceforth operate as Boston Woven Hose & Rubber Co. Division, with former officers continuing as officers of the Division.

American Biltrite operates four plants in the United States and Canada, manufacturing Biltrite soles and heels, Amtico vinyl and rubber floorings, and Biltrite garden hose.

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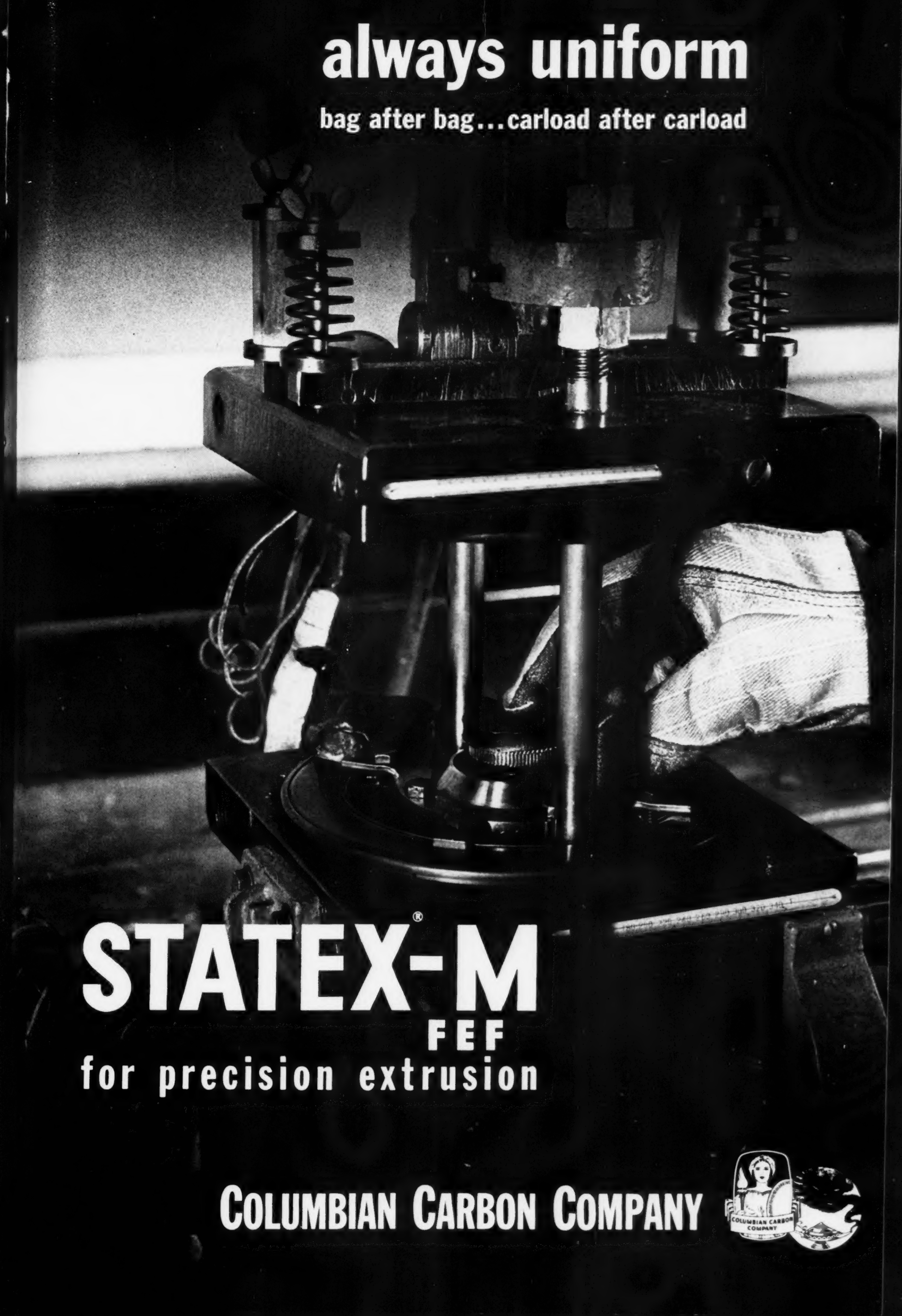
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American Hard Rubber Merged with Two Other Firms

American Hard Rubber Co. has merged with Bachmann Uxbridge Worsted Corp., both of New York, N. Y., manufacturer of fabrics, and Wardell Corp., formerly a Michigan manufacturer of vacuum cleaners and heating equipment.

The name of the resulting corporation is Amerace Corp. Stockholders of the three companies voted approval of the unanimous recommendation for merger of the three boards at separate special meetings on May 29.

The combined sales of American Hard Rubber and Bachmann Uxbridge in 1956 were $59,684,933. Since 1953 the assets of Wardell have consisted of funds equivalent to cash. These funds will approximate $5 million at the time of merger and will be available as additional capital.

Victor T. Norton, president of American Hard Rubber, was selected as president of Amerace Corp., chairman of the executive committee, and chief executive officer. Harold J. Walter, president of Bachmann Uxbridge, is company vice president and vice chairman of the executive committee.

Louis Bachmann, Jr., executive vice president of Bachmann Uxbridge, has been named a vice president, as has Newton H. Tuthill, vice president of American Hard Rubber. Budd E. Pollak and Felix P. Juraska, secretary and controller, respectively, of American Hard Rubber, and H. Nelson Flanders, Jr., treasurer of Bachmann Uxbridge will occupy the same positions in Amerace.

According to a released statement, the purpose of the merger was to create a financially strong and well-balanced business enterprise equipped to expand and diversify its activities in the areas of chemicals, plastics, hard rubber, battery components, chemical equipment, and wire and cable, in which American Hard Rubber is now engaged, and to compete successfully in the textile industry, in which Bachmann Uxbridge now operates.

American Hard Rubber has one major subsidiary, the wholly-owned Pequanoc Rubber Co., Inc., which produces reclaimed rubber and rubber and plastic custom compounds for industry.

Victor T. Norton

It has five other divisions: the hard rubber division, producer of hard rubber and plastic products; Supplex Co. Division, maker of plastic garden hose, sprinklers and pipe; Gavitt Wire & Cable Co. Division, manufacturer of specialty wire, cable, harness assemblies, and other components for the electronics industry; Electric Mfg. Co. Division, producer of multicolored plastic products; and Ace Comb Co. Division, manufacturer of consumer combs of plastic and rubber.

Bachmann Uxbridge owns and operates seven plants in New England and the South. It manufactures and sells fabrics from natural and synthetic fibers, some of which are sold to the United States Government for uniforms. The company is one of the largest enterprises in the woolen and worsted industry, both in volume of goods produced and dollar volume of sales, which amounted to $33,134,933 in 1956.

UCC Fellowship Building

A plan to construct a building for the Chemical Hygiene Fellowship research group of Mellon Institute has been announced jointly by Gen. M. B. Ridgway, chairman of the Institute's board of trustees, and D. B. Benedict, president of Union Carbide Chemicals Co., New York, N. Y., sponsor of the Fellowship since 1937.

The structure, to contain 30,000 square feet of floor space, will be located at tht Institute's Bushy Run Laboratories in Penn Township, 20 miles east of Pittsburgh, Pa. The new edifice will provide a substantial increase over the present space occupied by the Fellowship. Completion of the project is scheduled for March, 1959.

The work of the Chemical Hygiene Fellowship is to obtain information leading to the safe use of the processes or products of the various divisions of Union Carbide, the company says. The possible hazards of new chemicals are determined before samples are furnished customers.

Miller on RW Ad Staff

Robert Lee Miller, new eastern sales representative of RUBBER WORLD, was born in West Virginia; the town, Landisburg; the date, September 10, 1921.

He received his formal education at Greenbrier Military School, West Virginia University, and West Virginia Institute of Technology. After majoring in business administration, buying, and selling, he won his diploma in 1942.

Then Uncle Sam entered the picture. Until 1947, Miller was with the infantry. A second lieutenant, he was stationed in the Pacific for 36 months.

His business career (in selling) started with the Fayette Ice Cream Co. in Montgomery, W. Va. The year 1950, however, saw Miller with the First National Bank & Trust Co., Ridgefield, Conn., where he was head teller when he resigned early in 1957 to become eastern sales representative for RUBBER WORLD and also for *Tires—TBA Merchandising*.

Robert L. Miller

Bob is a devotee of Izaak Walton. He likes hunting too.

When not so occupied, he finds time for the Masons, the Ridgefield Board of Education (on which he has served four years), his local Volunteer Fire Department, Phi Sigma Kappa (W. Va. U.), and the 105 Air Base Squadron, NYANG, of which he is an executive officer, with the rank of captain.

Miller is married and lives with his wife and three young daughters at 32 Gilbert St., Ridgefield.

Du Pont Tire Yarn Talks

New developments and techniques in tire yarn research were presented to about 200 representatives of 18 rubber companies, yarn processors, and equipment manufacturers by members of the textile fibers department of E. I. du Pont de Nemours & Co., Inc., at the Portage Country Club, Akron, O., May 9.

William F. McDevit, nylon research supervisor for the company, described the physical properties and structure of nylon tire cords. Donald E. Howe, supervisor of Du Pont's industrial products research laboratory, summarized the present status of hot stretching nylon tire cord.

Willard W. Ransom, laboratory director for rayon research, spoke on the utilization of higher strength rayons. John M. Swanson, manager of the company's industrial products research laboratory, summarized advances made in tire aesthetics in tne past year.

Donald H. Heckert, tire merchandising supervisor, dealt with the reduction of cord content in nylon tires, emphasizing that a major industry objective in the last 15 years has been to reduce the cost of these tires.

Howard P. Brokaw, manager of Du Pont's rubber industry sales office, and Philip M. Walters, tire merchandising manager, were also present at the meeting.

Dayton in Puerto Rico

The Dayton Rubber Co., Dayton, O., has appointed Porto Rico Oil Co., San Juan, Puerto Rico, exclusive distributor in Puerto Rico and the Virgin Islands for Dayton automotive and industrial products. Dayton considers the island of Puerto Rico the fastest-growing industrial area in the Western Hemisphere.

More than 500 companies, 95% of them American owned, have set up manufacturing plants in Puerto Rico since 1947.

Dayton, however, has no plans for establishing manufacturing facilities on the island in the foreseeable future.

Porto Rico Oil Co. is one of the island's largest distributors of automotive, industrial, and petroleum products, serving more than 700 wholesale and retail outlets from its warehouse facilities.

New BFG Adhesive Plant

B. F. Goodrich Industrial Products Co. will build a $2,500,000 plant for the manufacture of adhesives on its main plant property in Akron, O., the first major expansion of Goodrich's Akron production facilities since a belt plant was erected there in 1950.

The new two-story plant will have 70,000 square feet of floor space and will employ about 100 people. There will be a development laboratory in addition to production facilities. Completion of the project is expected by 1958.

"This new plant will service the adhesives requirements of B. F. Goodrich manufacturing in Akron and will provide modern, safe facilities to meet the growing demands of our commercial customers," C. O. DeLong, president of Goodrich Industrial Products, said.

Bisphenol A Output Up

Monsanto Chemical Co., St. Louis, Mo., has doubled its production capacity for bisphenol A, a resin intermediate used in the manufacture of epoxy resins and oil-soluble phenolic resins. The St. Louis facilities, the company's first full-scale plant for bisphenol A production, was opened 18 months ago.

The rising demand for bisphenol A is attributed to the increasing production of epoxy resins, which totaled 30 million pounds in 1956, a 50% boost over 1955 U.S. output. About 70% of the epoxy resins go into surface coatings, especially primers.

Bisphenol A is also being used in the manufacture of polycarbonate resins, high melting point thermoplastic materials which reportedly offer an unusual combination of toughness, heat resistance, high impact strength, and good dimensional stability.

Monsanto is conducting development work on such potentially important derivatives as hydrogenated and chlorinated bisphenol A, compounds which may find application in resins, adhesives, agricultural chemicals, plasticizers, surface active agents, and pharmaceuticals.

Goodyear Factory Shifts

Changes in the factory management organization of The Goodyear Tire & Rubber Co., Akron, O., have been announced by Russell DeYoung, executive vice president.

W. S. Wolfe has been appointed director of domestic production, and J. E. Stafford has been appointed manager of industrial products production. R. A. Jay, manager, engineering, has been assigned the additional responsibilities for the functions of plant planning and methods and machine design.

Leroy Tomkinson, general superintendent, has been put in charge of Akron production operations, established as a plant unit.

Firestone Cuban Plant

A new Firestone tire plant with a capacity of 100,000 passenger, truck, and off-the-highway tires is nearing completion on a 50-acre plot 15 miles outside of Havana, Cuba. Construction, begun in October, 1956, is expected to be finished by October of this year.

About 500 people will be employed. Most of the tire building equipment which will be used in the plant has been delivered and is ready for installation, the company said. The Cuban plant will be Firestone's thirteenth outside the United States.

New Converse Warehouse

Converse Rubber Co., Malden, Mass., has opened a new $500,000 warehouse and office building in Melrose Park, Ill., for distributing its footwear in the Midwest area. The one-story structure, at 2000 Mannheim Road, has about 50,000 square feet of floor space. The building is serviced by a railroad siding as well as recessed, truck-level loading docks. A mobile conveyor system expedites handling of the Converse sport, athletic, and rubber footwear.

The new premises are about 12 miles west of the company's previous Chicago Loop location.

Cutting-Rule Steel

A cutting-rule steel for making dies with sharp angles or intricate shapes for cutting plastic, paper, canvas, leather, and other materials has been announced by Athenia Steel Division, National-Standard Co., Clifton, N. J.

The steel, said to be made by a new process, has hardness ranging from C36 to C50, depending upon ductility desired. The ductility permits bending over radii of only 0.025- to 0.125-inch, depending upon hardness specified, the company says.

The new cutting rule steel is available in any lengths in widths ranging from ¾-inch to 1½ inches and thicknesses from 0.028- to 0.42-inch.

D & A Gets Co 60

Dewey & Almy Chemical Co. Division of W. R. Grace & Co., Cambridge, Mass., has acquired a radioactive cobalt 60 source for use in organic chemical research.

The two-foot slender cobalt tube has been sealed in a protective two-ton lead sheathing about the size and the shape of a 55-gallon drum. Samples to be exposed are lowered inside the tube by means of a remote control device. The source was obtained from the Brookhaven National Laboratories of the Atomic Energy Commission.

Dewey & Almy was among the 24 United States companies to sponsor the nation's first private nuclear reactor for industrial research at the Armour Research Foundation, Illinois Institute of Technology.

Hercules School Grants

Hercules Powder Co., Wilmington, Del., is giving unrestricted grants-in-aid to a number of American colleges and universities for the second consecutive year. The 1957 scholarship program will total about $100,000 to be distributed among 26 schools.

Grants will go primarily to chemistry and chemical engineering departments of the schools. Twenty-three colleges and universities benefited from the grants last year, which amounted to $95,000.

"The purpose of this program is to encourage American colleges and universities to provide more and better technically trained personnel so vitally needed by industry and by our nation as a whole," A. E. Forster, president and board chairman of Hercules, said.

Goodrich Mucker Belt

A new type of mucker belt, especially designed by B. F. Goodrich Co., Akron, O., for conditions met in the 37,500-foot Poe tunnel project, 30 miles east of Oroville, Calif., has carried two-thirds of the more than 900,000 tons of rock excavated in the project, the company reveals.

The tunnel, built for Pacific Gas & Electric Co. under joint contract by Utah Construction Co. and Bates & Rogers Co., will divert water from the Feather River and conduct it to PGE's new hydro turbine generator plant.

Feature of the new belt construction is a special, interior fabric reinforcement designed to distribute shock loads from impact, improve cover adhesion, and reduce stretch, the company says. The new construction provides its own cushion against load impact since the belts operate across a steel slider bed which affords no additional cushioning protection.

The Goodrich mucker belts, 38 inches wide, were installed on four mucker machines in the project. Two were 57-foot belts; while the other two measured 47 feet. Belt thickness was $1\frac{1}{16}$ inches. The belts, traveling 300 feet a minute, conveyed the waste rock to a muck mine car, raising the load 12 feet on a 22-degree-angle incline.

General Air Spring Unit

The General Tire & Rubber Co. has established a new department for the manufacture of rubber air springs for the automotive industry at the Logansport, Ind., plant of its industrial products division. Cost of the new facilities, now being installed, is put at $1 million.

"The recent decision by the automotive industry to utilize the rubber air springs on their new models necessitated our establishing the air spring department in Logansport," W. O'Neil, president of General Tire, said in making the announcement.

Tumb-L-Matic Appoints

Tumb-L-Matic, Inc., Stamford, Conn., specialist in the finishing of rubber, plastic, metal, and wooden goods, has appointed Robert A. Howard head of its department of laboratory research and process development. Mr. Howard, a 10-year veteran in industrial sales and service, has taken charge of the company's sales service in addition to duties in the developing and perfecting of new techniques of wet and dry tumbling.

Tumb-L-Matic recently moved its facilities from New York, N. Y., to Stamford, where greater factory space is expected to result in a 30% production increase.

ILLINOIS' MISS CHEMICAL PROGRESS, COMELY DIANA Muller, a 19-year-old sophomore at Mundelein College, stops to chat with a rubber boot maker while on a tour of the Rock Island, Ill., plant of Servus Rubber Co. Accompanying her is Allen McVarney, technical director of the firm and 1956 chairman of the Iowa-Illinois Section of the American Chemical Society. Miss Muller was selected to represent chemical companies of Illinois during the recent Chemical Progress Week.

Two-Room Airhouse Exhibited at Home Show

A two-room, air-supported fabric house was displayed at the International Home Exposition, held in the New York Coliseum, New York, N. Y., May 4-12, by United States Rubber Co., New York.

The fabric is U. S. Rubber's Fiberthin, a vinyl-coated nylon fabric four times as strong as waterproof canvas, but 40% lighter in weight. The structure, called Frank Lloyd Wright Airhouse, was designed by the noted American architect, Frank Lloyd Wright.

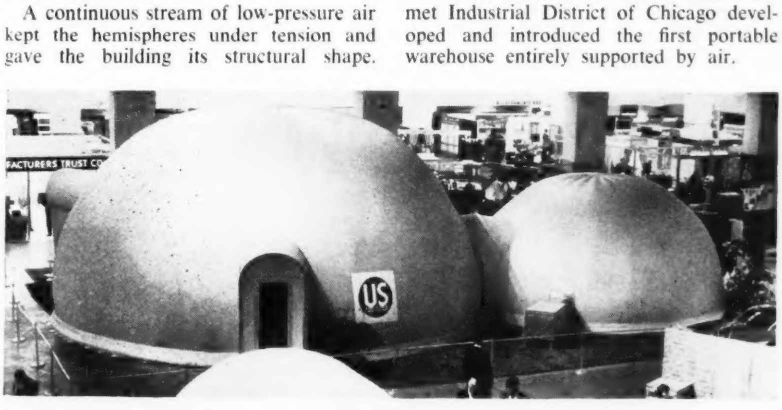
The Airhouse consisted of two hemispheres: the main unit 38 feet in diameter and 19 feet high; the second unit 24 feet in diameter and 12 feet high. Both were anchored to the ground by a tube filled with bags of sand extending around the base.

A continuous stream of low-pressure air kept the hemispheres under tension and gave the building its structural shape. The Irving Air Chute Co., Lexington, Ky., which fabricated the Wright Airhouse, plans to sell a comparable model for $2,245.

Fiberthin, which resists flame, sunlight and weathering, oils and most acids, was first developed for lightweight truck tarpaulins and is now being used also for boat and barge covers, sails, life rafts, and covers for baseball infields.

The Wright house was constructed of a series of Fiberthin panels sewn together, and the seams were sealed with a vinyl coating. According to U. S. Rubber, the Airhouse was shown "not as a structure destined to replace homes of brick or wood, but to demonstrate the potential of the air structure principle."

Last October, U. S. Rubber and Calumet Industrial District of Chicago developed and introduced the first portable warehouse entirely supported by air.



Two-domed Frank Lloyd Wright Airhouse at International Home Exposition

Firestone Race Tires Excel

A race car driven on tires of The Firestone Tire & Rubber Co., Akron, O., set a new international closed-course speed record at the Autodromo di Monza in Italy, May 4, during tire test runs that averaged 163.377 miles per hour for 77 laps totaling 226.5 miles.

The tires are similar in appearance to the company's Super Sports 170 tire, built around specifications perfected by Firestone during its participation in the Indianapolis 500-mile classic.

The Monza course is said to be the fastest race track in the world.

UCC Shortens Name

The name of Union Carbide & Carbon Corp., New York, N. Y., has been shortened to Union Carbide Corp., according to a company announcement. The names of three divisions of Union Carbide have also been changed: Carbide & Carbon Chemicals Co. to Union Carbide Chemicals Co.; Linde Air Products Co. to Linde Co.; and Carbide & Carbon Realty Co. to Union Carbide Realty Co.

Stockholders approved the change at the annual meeting of the corporation on April 16. Union Carbide Chemicals Co. produces more than 400 synthetic organic chemicals; while Linde Co. is one of the nation's leading oxygen producers. Union Carbide Realty Co. is responsible for managing the corporation's real estate, which includes more than 300 plants and about 125 sales offices in the United States.

Design Show Doubles In One Year, Draws 20,000

Nearly 20,000 technical and sales representatives gathered at the New York Coliseum, May 20-23, to attend the second annual Design Engineering Show, sponsored by the Machine Design Division, American Society of Mechanical Engineers. The show featured more than 10,000 products and materials displayed by nearly 400 manufacturers. Having more than doubled in size during the two years of its existence, the show is now rated among the top five annual industrial expositions in the United States. The general public was not admitted.

Conference Papers

Held concurrently with the show, the three-day Design Engineering Conference (May 20-22) drew an aggregate audience of 1,750 persons. The Conference was devoted to sessions on new product design and the mechanical, materials, and electrical aspects of design engineering.

A paper on "Plastics and Rubbers" by Wyman Goss, manager, phenolics engineering, chemical materials department, General Electric Co., Pittsfield, Mass., was presented at the Wednesday session, in addition to a discussion on "Coatings and Finishes," by H. J. Reindl, supervisor, research and development, finishes section, Inland Mfg. Division, General Motors Corp., Detroit, Mich.

Mr. Goss pointed out that older materials of construction are being replaced in many fields and that in the automotive industry alone, 10 different plastic materials or copolymers are being used in electrical systems, fuel systems, body transmissions, running gears, engines, and accessories. Vinyls, styrenes, polystyrenes, and phenolics are other resins that are being used to produce some four billion pounds of products annually.

Three general classes of coatings were discussed by Mr. Reindl. These included organic coatings such as varnishes and enamels, and also epoxy, chlorosulfonated polyethylene (Hypalon), and polyurethane types; metallic coatings, in which high vacuum metallizing process, electrically conductive coatings, and others were considered; and conversion coatings which covered oxide-on-metal finishes.

Design Show

Some of the highlights of the show, included the Dow Corning Corp. booth at which a completely silicone insulated D.C. motor was displayed. The material used was Silastic Type K Interlayer originally developed for high-temperature safety glass windshields on supersonic aircraft. Also shown were samples of Dow Corning 7501 and 7521, solventless silicone impregnating and encapsulating resins.

Russell Mfg. Co. demonstrated an ultra-speed transmission belt made of neoprene bonded with Dacron. Used with small-diameter pulleys, the belt is said to give reliable service at speeds in excess of 100,000 rpm.

B. F. Goodrich Chemical Co. displayed many commercially available products in which Geon polyvinyl materials or Hycar nitrile rubber is an important component. Among the items were welded rigid vinyl housings, plastisol coated metals, vinyl foam and sponge, rigid vinyl pipe, and other specialized extruded shapes. Hycar was represented by molded and extruded industrial goods, latex bound non-woven fibers, rubber-phenolic resin electrical components, and many saturated and coated paper compositions.

A new series of synthetic rubber base sealers called "Weatherban" was displayed by Minnesota Mining & Mfg. Co., adhesives and coatings division. The sealers chemically cure in place to produce a solid rubber seal which possesses flexibility, durable aging qualities, excellent adhesion to metal, glass, porcelain, masonry and other common building materials. Also available for inspection were samples of "Scotchfoam," a thermosetting, self-curing polyurethane foam that can be foamed in place to produce a rigid cellular material that will not break loose, settle, or sag. Design features claimed for this product include: low weight factor, adhesion to many types of surfaces including most metals, can be cured without heating, freedom from fire during application, and applicability to irregular surfaces without the necessity of cutting and fitting.

Flexible Tubing Corp. exhibited a series of lightweight, flexible ductings for a wide variety of design applications. One type, Flexflyte, is constructed of spirally wound, bonded layers of neoprene coated sheets and cotton fabric reinforced by a wire helix. The construction will vary with application. Linings and coverings may be made of coated fiber glass or cotton, and standard coatings are available in vinyl, neoprene rubber, nitrile rubber, and silicone rubber.

In addition to its Poly-Koolfoam foamed-in-place polymer formulations, Dayton Rubber Co. exhibited its QVD fractional horsepower V-belt. The belt was designed to operate with exceptional quietness on such light-duty drives as furnace blowers, air conditioning blowers, light precision machinery, etc.

Among the displays presented by the E. I. du Pont de Nemours & Co., Inc., were samples of neoprene synthetic rubber, urethane foams based on Hylene organic isocyanates; lucite acrylic plastic, Alathon polyethylene plastic, Teflon tetrafluoroethylene plastic, and Mylar polyester film.

Garlock Packing Co. exhibited molded rubber packings, mechanical packings, and mechanical seals in addition to Kel-F, Teflon, and silicone plastics.

The O'Sullivan Rubber Co. booth featured Sulvyne-Clad, plastic sheeting bonded to flat sheets of aluminum, steel, and magnesium; and Sullvac, a rigid and semi-rigid thermoplastic modified styrene copolymer sheeting for vacuum molding.

Raybestos-Manhattan, Inc., displayed mechanical packings and gasket materials, asbestos products for reinforced plastics, power transmission equipment, and poly-V drives.

Most of the exhibitors were pleased with the results of the show and felt that a large volume of business could be expected as many inquiries were made and many tentative orders were placed.

S. H. Tinsley

Sam Tinsley Retires

Samuel H. Tinsley, for more than 20 years associated with R. T. Vanderbilt Co., New York, N. Y., in development work and technical sales and service, has retired.

Mr. Tinsley's retirement results from a heart attack he suffered almost a year ago and from which he has not fully recovered, the company said. He plans to move to Florida in the near future.

After receiving his B.S. and M.S. degrees from the University of Virginia, Mr. Tinsley did graduate work at Massachusetts Institute of Technology. He was chief chemist for Respro, Inc., and later became development and plant manager for Coated Textile Mills, Inc., before joining Vanderbilt in 1937.

Conveyor Belt Repairing

A new national service for repairing and rebuilding large conveyor belts has been announced by Conveyor Belt Service, Inc., Virginia, Minn. The firm has been conducting such repairs in the Mesabi Iron Range.

Belts costing \$5 to \$100 a foot have been successfully rebuilt and returned to service in good condition after end-to-end rips, transverse cuts, impact breaks, cover tears, and edge injuries, according to William A. Mars, president of the company.

The repairs to carcass, cover, and edges are made with identical fabrics, gums, and rubber compounds employed in the original manufacture. Plant equipment includes specially designed drying oven, temperature controls, moisture detecting devices, belt tables, and steam vulcanizing press.

A brochure outlining the company's services is available on request.

UCC Plans Tech Lab

Union Carbide Chemicals Co., New York, N. Y., has announced plans to build a technical service laboratory on its Westchester County property near Tarrytown, N. Y. The laboratory will include facilities and personnel to serve a total of 24 major industries, including rubber, plastics, petroleum, automotive, and surface coatings.

The three-story, 360- by 60-foot structure will have 63 individual laboratory units, including analytical facilities with provisions for tracer chemistry and a 200-seat auditorium for seminars and other technical meetings. Salesmen will get a substantial part of their training at the laboratory before being assigned to the field.

Completion of the project is scheduled for early 1959.

Rayon Tire Cord Surveyed

More than 60 million miles of rayon cord will go into original equipment tires for U. S. auto manufacturers this year, according to George Storm, vice president and general manager of the rayon division of American Viscose Corp., New York, N. Y.

More than 99% of the new cars produced this year—238 of the 240 auto models offered—will be factory equipped with tires reinforced by rayon cord, he said, adding that rayon cord now in production is 50% stronger than was the rayon cord which was used in tires two years ago.

Five companies produce rayon cord for the tire industry in this country. About one-third of their total cord production will go into new-car original-equipment tires this year, with the remainder earmarked for the replacement-tire market.

U. S. Rubber in Belgium

United States Rubber Co., New York, N. Y., has acquired a "substantial" minority interest in Englebert & Co., Liege, Belgium, one of the oldest and largest tire manufacturers in Europe, with plants in Liege; Aachen, Germany; and Clairoix, France.

According to H. E. Humphreys, Jr., U. S. Rubber president, the company now has facilities available for the manufacture of U. S. Royal tires in Belgium, France, and Germany, in modern plants favorably located with respect to major European automotive manufacturers and to European plants of United States motor companies.

Englebert is said to be the largest tire manufacturer in Belgium and is the principal supplier for General Motors cars assembled in that country. The company also manufactures tires for bicycles and other vehicles, as well as industrial rubber products.

U. S. Rubber is supplying research and development assistance to Englebert under technical service agreements.

New Dow Corning Plant

Dow Corning Corp., Midland, Mich., is building a new plant for manufacturing silicone consumer products at Greensboro, N. C. The firm is also establishing a silicone specialties division as a separate operating unit with headquarters in Midland.

The new plant will occupy about 35,000 square feet of space and will initially employ 35 persons when it begins operations in late summer. Products to be manufactured there include eyeglass cleaning tissues, a formulation for preserving and protecting leather from rain and snow, and Dow Corning 4X Compound for lubricating automobile gasketing rubber and for insulating and sealing ignition systems from moisture.

Radiator Hose Test

The Dayton Rubber Co. has developed a radiator hose test at its Waynesville, N. C., plant that closely duplicates service experience. The test apparatus simulates the vibration between an automobile engine and the radiator.

Hoses are given an accelerated aging at 212° F. for 72 hours prior to the test to simulate normal shelf life. The test fluid circulated is a 50-50 mixture of water and ethylene glycol with some oil-type rust inhibitor added.

Details of the test are reported in E. I. du Pont de Nemours & Co.'s Elastomers Notebook, Issue 75 (April, 1957).

Uscolite Pipe Lauded

A report on the performance of United States Rubber Co.'s Uscolite rubber-resin blended pipe which replaced the copper piping in the rotary filters of the filtering plant of the West-Southwest Sewage Treatment Works of the Metropolitan Sanitary District of Greater Chicago has been released.

Officials of the Sanitary District said that ferric chloride corrosion of the copper pipe which made repair and patching leaks a continuous job at the world's largest sewage treatment system has been eliminated by the adoption of the rubber-resin pipe.

Obituaries

Stephen G. Luther

Stephen G. Luther, director and former vice president of Midwest Rubber Reclaiming Co., East St. Louis, Ill., died May 16 after an extended illness. He had retired from the company in October, 1956.

The deceased was born in Tiverton, R. I., September 19, 1876. He attended Wooster Polytechnic Institute, graduating in 1899 with a degree in mechanical engineering.

He began his association with the rubber reclaiming industry by joining U. S. Rubber Reclaiming Co. in 1910. Soon after Mr. Luther was given the task of constructing a reclaiming plant in Russia. In 1913 he became factory manager for Philadelphia Rubber Works Co.

He joined Akron Rubber Reclaiming Co. in 1927. This subsequently became Midwest Rubber Reclaiming Co., of which Mr. Luther was made general manager in 1929. Further expansions of the company were directed by him.

Surviving are the widow, two sons, and a daughter.

John Gammeter

John Gammeter, whose inventions of rubber machinery revolutionized the rubber industry, died at his home in Akron, O., April 25, at the age of 81.

One of America's great inventive geniuses, Mr. Gammeter had almost 300 United States patents credited to him. It was often said that he was to rubber what Edison was to electricity and Charles Kettering is to the automobile.

Born in Akron, Gammeter began his long association with The B. F. Goodrich Co. as a carter of scrap rubber at a wage of 10¢ an hour. His formal education had stopped with the second grade.

His first invention, conceived and developed in his spare time without company knowledge, was a machine for trimming rubber stoppers. From that time on he was given great liberty in developing his ideas.

He invented the vacuum box for taking the flat carcass of a tire and, through air pressure, forcing it into the form of a tire. This became standard equipment in all tire factories. He perfected the hydraulic steam vulcanizer. He was considered the father of the modern golf ball, having developed the system of winding strips of elastic around a hard rubber center.

Mr. Gammeter also invented delicate gum-dipping machinery which helped advance the American rubber industry.

In 1920 the deceased made an arrangement with Goodrich in which he was given a free hand in developing inventions not necessarily of use in the rubber industry. Soon after, he developed a new type of steel cable which was said to have earned for him more than $200,000.

During World War I and after he was the guiding hand in Goodrich's production of dirigibles.

Later he operated his own laboratories and was consultant for nine large concerns, including A. G. Spalding Co. and United States Rubber Co.

Mr. Gammeter is survived by his wife and a sister, in addition to several nieces and nephews.

Services were held for him in the Billow Akron Chapel. Burial was in Glendale Cemetery.

News About People

Robert E. Frost has joined the staff of the B. F. Goodrich Co. Research Center, Brecksville, O., as a research chemist.

Alex B. Bourquard, treasurer of The Ohio Rubber Co. Division of The Eagle-Picher Co., Willoughby, O., has been elected to membership in the Controllers Institute of America.

George J. Weisenbach has joined The Wooster Rubber Co., Wooster, O., as assistant to the vice president in charge of sales. He was previously a sales executive for Pacific Mills of Wamsutta Corp.

J. Chester Ray has been named director of customer relations for the tire division of United States Rubber Co., New York, N. Y. He was formerly executive assistant to the general manager of the tire division.

Robert V. Yohe, vice president of sales for B. F. Goodrich Industrial Products Co., Akron, O., has been elected to the executive committee of American Supply & Machinery Manufacturers Association, Inc.

Peter F. Zachares has been appointed sales engineer in the New York metropolitan area for the process equipment division of Rodney Hunt Machine Co., Orange, Mass.

Maurice W. Richardson has joined C. A. Litzler Co., Inc., Cleveland, O., as sales engineer for textile process equipment. His former associations include the aeronautical division of B. F. Goodrich Co.

Robert H. Walsh has been named assistant director of the elastomers laboratory of E. I. du Pont de Nemours & Co., Inc., near Wilmington, Del., succeeding **Arthur M. Neal,** who died in April. Since 1953, Mr. Walsh has headed a fluid systems group on the development of urethane foams. An article on this subject appears in this issue of RUBBER WORLD, together with additional biographical data concerning Mr. Walsh.

Royal P. Tuthill has joined the yarn sales section of the textile division of United States Rubber Co., New York, N. Y., as supervisor of product development and technical service for tufting, chenille, and floor covering yarns.

Louis J. Jaworski has been made manager of government services for the chemical division of Borden Co., New York, N. Y. He was previously product manager of the division's industrial adhesives department.

Peter F. Schidrowitz, manager director of Latex Process & Dispersions Co., Ltd., Elton Fold Mills, Bury, Lancs., England, is visiting the General Latex & Chemical Corp., Cambridge, Mass., with which the British firm is now associated.

George P. F. Smith, vice president and eastern representative of Borg-Warner Corp., Chicago, Ill., has assumed the additional responsibility of operating the company's Washington, D. C., office, succeeding **Karl J. Ammerman,** who has retired as Washington manager.

Mrs. Martha H. White has been appointed director of public relations for Mobay Chemical Co., St. Louis, Mo.

John T. Sullivan, Edwin Y. Chung, and **Leo J. Martin** have joined The Richardson Co., Melrose Park, Ill., and will serve in the newly formed commercial development department.

Elwood W. Phares has been promoted to manager of marketing and commercial development of Velsicol Chemical Corp., Chicago, Ill. **John K. Kronseder** has joined the company as assistant director of process development.

Marion B. Geiger has been appointed director of general development for Hooker Electrochemical Co., Niagara Falls, N. Y. He was previously general manager, Oldbury Products.

R. M. Joslin has been appointed manager of the fine chemicals department of Union Carbide Chemicals Co., New York, N. Y., and is succeeded as sales manager of industrial chemicals by **W. A. Woodcock.**

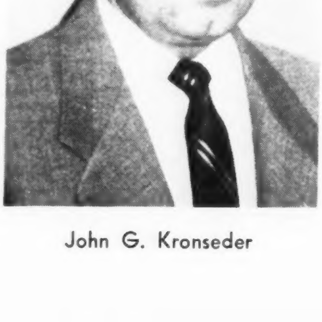
D. W. Gates has been named to the newly created position of manager of automotive chain-store sales in the associated tire and accessories division of B. F. Goodrich Tire Co., Akron, O. **Grover C. Clark** has been advanced to merchandising manager of the division and is succeeded as advertising and sales promotion manager by **Robert O. Howard.**

Joseph C. Duke and **Bert S. Cross,** vice presidents of Minnesota Mining & Mfg. Co., St. Paul, Minn., have been elected to the firm's board of directors. Reelected to the board were **William L. McKnight,** chairman; **Herbert P. Buetow,** president; **Archibald G. Bush, John L. Connolly, John C. Dwan, George H. Halpin, John G. Ordway, Clarence B. Sampair,** and **Louis F. Weyand.**

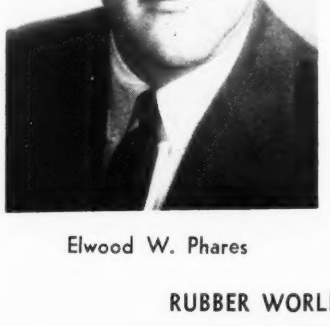
Howard B. Smith, Jr., has been appointed sales engineer in the Middle Atlantic area for the process equipment division of Rodney Hunt Machine Co., Orange, Mass.

Jess E. Bunch and **Richard A. Noblett** have been appointed manager and assistant manager, respectively, of the plating equipment division of Automotive Rubber Co., Inc., Detroit, Mich.

Joseph Mangion has joined Wild & Stevens, Inc., Newton Upper Falls, Mass., as manager of its rubber manufacturing division at Woburn, Mass.



John G. Kronseder



Elwood W. Phares

Baboo Ram Teree has been elected vice president in charge of engineering and manufacturing at Greer Hydraulics, Inc., Jamaica, N. Y.

Doug Ford and **Dow Finsterwald,** professional golfers, have joined the golf advisory staff of Dunlop Tire & Rubber Corp., Buffalo, N. Y.

Charles F. Biggs has been named chief plant engineer for the Seiberling Rubber Co., Akron, O., replacing **M. S. Cole,** who has resigned.

Charles Aust has been promoted to technical director of Goshen Rubber Co., Inc., Goshen, Ind., and has been succeeded as chief chemist by **Louis Rhodes,** who recently joined the company.

John Forney Rudy has been appointed assistant to R. S. Wilson, executive vice president of The Goodyear Tire & Rubber Co., Akron, O. Rudy will headquarter in Washington, D. C.

John J. Keville has been appointed sales manager for the eastern sales territory of the polymer chemicals division of W. R. Grace & Co., and will headquarter in Clifton, N. J.

Seymour Beyer has been named sales representative in the Queens County, N. Y., area for Lee Rubber & Tire Corp., Conshohocken, Pa.

Nathaniel B. Nichols has rejoined Taylor Instrument Cos., Rochester, N. Y., as chief engineer, succeeding **Ralph E. Clarridge,** who has been named to the president's staff as specialist for new product lines. **John E. Barber** has been appointed assistant manager of the firm's application engineering department; while **Elliott M. Barr, Donald T. Gregg,** and **Henry Stoll** have been named group leaders in the department.

Nathaniel B. Nichols

Robert A. Maxwell has been named manager, equipment sales-Detroit, for B. F. Goodrich Tire Co., Akron, O., succeeding **George J. Stritch,** who has retired after 40 years of service with B. F. Goodrich.

Daniel P. Shedd has joined Mobay Chemical Co., St. Louis, Mo., as a sales development specialist. He was formerly a technical sales specialist for Monsanto Chemical Co.

Gabriel A. Popper has been added to the research and development department staff of the Barrett Division, Allied Chemical & Dye Corp., New York, N. Y.

Herbert A. Clark has been elected a trustee of Underwriters' Laboratories, Inc., Chicago, Ill., succeeding **W. A. Rattelman,** who died recently. **Guy E. Manning** has been elected vice president and chief engineer, and **Karl S. Geiges** has been elected vice president at the organization's Santa Clara, Calif., office. **H. B. Whitaker** has been appointed assistant to the vice president in New York; while **Donal L. Breting** has been selected to serve as superintendent of label service in Chicago. All other active trustees and officers of the corporation were reelected.

Carl F. Lamanna has been promoted to sales manager of the consumer products division of Tyer Rubber Co., Andover, Mass. **Philip MacLean** has been named assistant sales manager of this consumer products division.

David B. Squibb, Jr., has been named to a staff position in the manufacturers' sales department of The Goodyear Tire & Rubber Co., Akron, O.

Edward E. Slowter, secretary and business manager of Battelle Memorial Institute, Columbus, O., has been elected a vice president.

Keith T. Scanlan has been appointed field salesman for the contract sales division of The Sun Rubber Co., Barberton, O.

Roderick K. Eskew has been given the United States Department of Agriculture's Superior Service Award in recognition of his "outstanding initiative and leadership in the origination and development of new processes and products whch have resulted in increased utilization of agricultural products." Now engineering head of the Department's Wyndmoor Laboratory, Mr. Eskew during the war directed a research program which resulted in the development of processes for obtaining rubber from the guayule plant and from the Russian dandelion.

A. B. Gordon has been appointed product manager of the Koroseal film and coated fabrics department of B. F. Goodrich Industrial Products Co., Marietta, O.

E. B. Hathaway

E. B. Hathaway, since 1948 sales manager of The Firestone Tire & Rubber Co., Akron, O., has been elected vice president in charge of trade sales. He succeeds **H. D. Tompkins,** who will continue as a vice president of the company. Mr. Hathaway joined Firestone in 1927.

Charles Barnhardt, manager of battery sales and imported tire division of Dunlop Tire & Rubber Corp., Buffalo, N. Y., will devote his full-time duties to management of the imported tire division. **F. T. Windsor** has been named manager of the battery sales division and will continue as petroleum marketer sales manager.

C. R. Porthouse, president and a director of Pyramid Rubber Co. and Harcort Mfg. Co., has been elected to the board of directors of Alco Oil & Chemical Corp., Cleveland, O. He succeeds **Frank Taplin,** now assistant to the president of Princeton University.

John Ware has resigned as vice president in charge of sales, treasurer, and director of Kenrich Corp., Maspeth, N. Y. **Paul M. Goodloe** has been elected a director of the company. **Mrs. J. L. Spiegelhalder,** assistant secretary and a director, has been elected treasurer.

R. E. Workman, manager of the chemical division of Goodyear International Corp., Akron, O., has been awarded a Sloan Fellowship for participation in the executive development program at Massachusetts Institute of Technology.

Joseph C. Duke has been elected executive vice president in charge of coated abrasives and adhesives and coatings for Minnesota Mining & Mfg. Co., St. Paul, Minn. **Bert S. Cross** has been elected executive vice president in charge of graphic products. **Byron J. Oakes** and **Cecil C. March** have been elected vice presidents of the chemical products group and the coated abrasives and related products division, respectively.

George V. Lang

George V. Lang has been elected a vice president in addition to his present office of treasurer of United Engineering & Foundry Co., Pittsburgh, Pa. **Warren S. McKay** has been elected assistant treasurer, and **N. J. Chavern** has been chosen secretary of the company's retirement board.

William J. Hanlon and **Edward J. Serwan** have been appointed technical superintendent and production superintendent, respectively, at The General Tire & Rubber Co.'s Ashtabula, O., chemical plant.

Oliver F. Redd has joined Dravo Corp., Pittsburgh, Pa., as technical service consultant in the process equipment department.

H. Stanley Lawton has been elected vice president in charge of sales and market development for Michigan Chemical Corp., St. Louis, Mich. Before joining the company, Mr. Lawton had been associated with Hercules Powder Co. and Dewey & Almy Chemical Co.

Koby, Cambridge

H. Stanley Lawton

Andrew G. Duzsik has joined Borden Co.'s chemical division, New York, N. Y., as manager of manufacturing operations for its Resinite department and will be headquartered at the firm's Santa Barbara, Calif., plant.

C. E. Cain has been made head of a new planning department at Alco Oil & Chemical Corp., Philadelphia, Pa. He has been succeeded as head of the company's sales service laboratory by **Carl W. Denfeld,** a member of the chemical sales service staff since 1953. **Robert A. Moctezuma** has joined the company as an analytical chemist.

Whiting N. Shepard has been appointed manager of Plaskon molding compound sales for Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., succeeding **Henry W. DeVore,** recently promoted to director of plastics and resins sales.

E. C. Brown, Jr.

E. C. Brown, Jr., has been reassigned to the New York office of the chemical division of The Goodyear Tire & Rubber Co., Akron, O. He will service rubber and plastic processing companies in the New York City area.

Paul F. Derr has been promoted to the post of laboratory section director in the research and development department of Westvaco Chlor-Alkali Division, Food Machinery & Chemical Corp., at South Charleston, W. Va.

Ralph W. Deemer has been advanced from production manager to factory manager of Republic Rubber Division, Lee Rubber & Tire Corp., Youngstown, O. **J. Paul Mathews** has been promoted from chief chemist to manager of development and research.

George J. Bruyn has been appointed manager, New England district sales, for Hooker Electrochemical Co., Niagara Falls, N. Y. He will headquarter at the company's new Worcester, Mass., office.

R. G. Jeter has been elected vice president and general counsel and secretary of The B. F. Goodrich Co., Akron, O. **E. A. Stevens** has been elected vice president and treasurer.

Charles C. Jarchow, president and a director of American Steel Foundries, has been elected to the board of directors of Universal Oil Products Co., Des Plaines, Ill.

John Platner has been advanced to assistant manager of the coatings department of the chemical division of The Goodyear Tire & Rubber Co., Akron, O., succeeding **G. H. Campbell,** recently transferred to Goodyear International Corp., **J. P. Talley** replaces Mr. Platner as a sales service representative for the department. **E. W. Scott,** formerly sales service representative for specialty coatings, has been named manager of sales development for the department.

T. Curry Jones

T. Curry Jones has been advanced to manager of the new Mid-Atlantic sales district of Enjay Co., Inc., New York, N. Y.

Robert W. Murphy, vice president and general counsel for Borg-Warner Corp., Chicago, Ill., has been elected chairman of the company's executive committee, succeeding **G. A. Shallberg, Sr.,** who has retired. **George P. F. Smith,** assistant to the chairman of the board and former president of the Norge and Marbon Chemical divisions of Borg-Warner, has been named vice president of the executive committee. **C. A. Barnes** has been elected an assistant treasurer.

John Mandel, an analytical statistician in the organic and fibrous materials division of the National Bureau of Standards, Washington, D. C., has been awarded the Department of Commerce Silver Medal for meritorious Service for his "meritorious authorship in the field of applied statistics, and noteworthy achievement in the application of statistical methods in scientific research and testing."

Hiram B. Young has been appointed vice president and **F. Leonard Bryant** vice president-production of Hooker Electrochemical Co., Niagara Falls, N. Y. Mr. Young, who has been vice president in charge of eastern production, will assume broader responsibilities. Mr. Bryant had been responsible for manufacturing operations of the Niagara plant and the Durez Plastics Division plants.

G. M. Thoman has been appointed assistant district manager of industrial chemical sales in Chicago for Stauffer Chemical Co., New York, N. Y.

W. E. Korsan has been made manager of sales of the electrical application department of Allis-Chalmers Mfg. Co., Milwaukee, Wis., and has been succeeded as manager of the St. Louis district by **J. C. Lovelace. W. M. O'Connor** has been named manager of the Amarillo district of Allis-Chalmers Industries Group.

Frank W. Silva

Frank W. Silva has been appointed technical service manager for associate company relations of B. F. Goodrich Chemical Co., Cleveland, O., in which position he will provide technical service to the firm's associate companies in England, Brazil, Mexico, and Japan and will be concerned with all technical phases of the operations of these companies. He was previously director of the company's polyvinyl chloride plant in Brazil.

B. V. Edmunds and **James H. Joyner** have been appointed works manager and general manager, respectively, of Quaker Rubber Division, H. K. Porter Co., Philadelphia, Pa.

Clifford F. Rassweiler, vice chairman of the board of Johns-Manville Corp. and president-elect of the American Chemical Society, has been awarded the 1957 Honor Scroll of the New York Chapter of the American Institute of Chemists for his "outstanding contribution to the chemical profession" in the New York area.

Arnold J. Morway, a chemist with Esso Research & Engineering Co., New York, N. Y., has received his 150th United States patent, No. 2,790,769, covering an improved method of manufacturing Andok, a high-temperature grease for anti-friction bearings.

Howard E. Everson has been named chief staff engineer in the central engineering department of Diamond Alkali Co., Cleveland, O.

Francis J. Oberhausen has joined The Electric Auto-Lite Co., Toledo, O., as administrative assistant to the chief engineer of the wire and cable division. **Robert A. Barker** and **N. B. Cawthorne** have been named section engineers in charge of specialized research and development areas; while **H. W. Borgman** has been appointed a project engineer for the division. **Leo O. Ravina** has been named resident engineer.

Donald B. Morgan

Donald B. Morgan has been added to the New Orleans district sales staff of Pennsylvania Industrial Chemical Corp., Clairton, Pa.

Edward L. Mears has been assigned the newly created post of general manager of the container and chemical specialties division of Dewey & Almy Chemical Co. Division of W. R. Grace & Co., Cambridge, Mass.

John Grotzinger, manager of the electrical engineering division of The Goodyear Tire & Rubber Co., Akron, O., has been elected to the grade of Fellow in the American Institute of Electrical Engineers.

William H. Shields, assistant to the research director of Emery Industries, Inc., Cincinnati, O., has retired after 32 years of service with the company. He directed the planning and erection of the firm's Twitchell Memorial Laboratories.

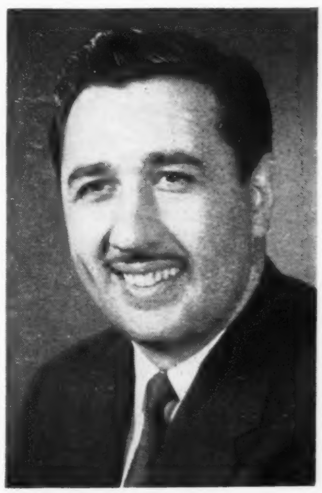
Michael W. Huber

Hans W. Huber has been elected chairman of J. M. Huber Corp., New York, N. Y., and **Michael W. Huber** has been elected president. Hans Huber has been with the company since 1918 and has been president since 1933. Michael Huber joined the company in 1949.

Richard E. Tisch and **W. A. McGee** have been named vice presidents in charge of product development and materials development, respectively, for A-P-D Co., Minneapolis, Minn., recently organized affiliate of Minnesota Rubber & Gasket Co.

Arthur J. Stock has been appointed research and development manager for Acheson Colloids Co., Port Huron, Mich., replacing **Harold J. Dawe,** now research director for Acheson Industries, Inc., the parent company.

Salvatore J. Iuliano has been appointed production superintendent at The General Tire & Rubber Co.'s plant in Amsterdam, The Netherlands. He joined the company in 1941.



Salvatore J. Iuliano

News Briefs

Alco Oil & Chemical Corp., Philadelphia, Pa., has named Pacific Polymers, Inc., Hawthorne, Calif., West Coast sales agent for its complete product line.

The Firestone Tire & Rubber Co.'s Lake Charles, La., plant, one of the world's largest synthetic rubber plants, produced its one-millionth ton of synthetic rubber on May 20. Production capacity of the facilities is rated at 190,000 tons a year, 90% more than the original capacity of the plant, which was constructed in 1943.

United States Rubber Co.'s Trilok, a "three-dimensional" fabric made by the company's textile division, was used to upholster the seats of the new Cinestage Theatre, Chicago, Ill.

The B. F. Goodrich Co., Akron, O., has been awarded a "certificate of outstanding achievement" by the American Public Relations Association for its promotion of highway safety during 1956.

Deecy Products Co., Cambridge, Mass., is boosting its Staflex plasticizer production capacity by 12 million pounds a year.

The Goodyear Tire & Rubber Co., chemical division, Akron, O., has opened a new field office at 6500 Mt. Elliott Ave., Detroit, Mich., under the supervision of L. P. Thies.

Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., is doubling production of Plaskon melamine and urea molding compounds at its Toledo plant, which, it is claimed, will become the largest thermosetting resins plant in the country when the expansion program is completed by mid-1959.

The Firestone Tire & Rubber Co. and **The B. F. Goodrich Co.,** both of Akron, O., were among the recipients of the National Safety Council's 1956 Public Interest Award. The advertising campaigns of the two companies were cited by the Council for exceptional service to safety. Both contributed space in many advertising media for the promotion of accident prevention.

Baker Castor Oil Co.'s president, Eric G. Orling, called reports of an impending castor oil shortage "unduly pessimistic." The head of the New York, N. Y., firm said accelerated production of castor beans in the United States and in other areas would meet the world's requirements.

The Goodyear Tire & Rubber Co., sales division-foam products, Akron, O., has established a sales office at Charlotte, N. C., to service requirements of an expanding furniture industry in the southeastern area. Alton N. McCotter has been named manager of the new field division.

American Cyanamid Co., rubber chemicals department, Bound Brook, N. J., has reportedly improved its MBTS (benzothiazyldisulfide) rubber accelerator, incorporating more freedom from dust, greater dispersibility, more uniform particle size, higher purity, a minimum of ash, complete absence of magnetic iron particles, and denser packing for its shipments.

The Firestone Tire & Rubber Co.'s Airide air springs are being used on a new boat trailer, introduced by Bassick Co., Bridgeport, Conn., which can transport boats from 40 to 1,400 pounds. The air pressure in the rubber bellows of each spring can be accommodated to the weight of the boat. The trailer has been dubbed Bassick Beaver.

Columbia-Southern Chemical Corp., Pittsburgh, Pa., has reduced the price of its Hi-Sil 233, a reinforcing silica filler for rubber, more than 11% to 8¢ a pound.

National Distillers Products Corp., New York, N. Y. has changed its name to National Distillers & Chemical Corp. Its chemical business will continue to be conducted under the divisional name U. S. Industrial Chemicals Co.

Monsanto Chemical Co.'s plastics division has boosted its Texas City, Tex., plant's ethylene production capacity by 150%. The company's entire ethylene production is used internally.

The Goodyear Tire & Rubber Co., Akron, O., is equipping the Fairchild F-27 Friendship, new propjet transport tailor-made for short- and medium-range operators, with its Tri-Metallic disk brakes and cast wheels which enable the transport to land on airstrips as short as 3,000 feet.

United States Rubber Co. is building a new branch office and warehouse in Dallas, Tex., to serve the Texas, New Mexico, Oklahoma, and Arkansas areas.

Alco Oil & Chemical Corp.'s Vulcanol Adhesive AL-1003 in conjunction with foam rubber matrices is being used by a Lewiston, Pa., chiropodist, Sidney C. Sivitz, to make toe shields as an aid to foot care.

The Firestone Tire & Rubber Co.'s rubber growing and associated activities in Liberia were depicted in that country's pavilion at the New York World's Trade Fair which opened April 14 at the Coliseum, New York, N. Y. In 1955, Liberia exported more than $33 million worth of natural rubber. Firestone plantations there cover 85,000 acres.

The Goodyear Tire & Rubber Co., aviation products division, Akron, O., conducted a 1957 Airplane Wheel, Brake and Tire Clinic, April 24-25, which was attended by more than 70 engineering representatives from aircraft manufacturers, commercial airlines, and the military services.

United States Rubber Co.'s George Mikan Award to the most improved college basketball team in the country during the 1956-57 period has gone to The Citadel, Charleston, S. C.

Financial

Brunswick-Balke-Collender Co., Chicago, Ill. First three months, 1957: net earnings, $136,177, equal to 20¢ a share, contrasted with net loss of $107,105 in the first quarter of 1956.

DeVilbiss Co., Toledo, O. March quarter, 1957: net income, $407,828, equal to $1.13 a share, against $334,337, or 92¢ a share, in last year's quarter.

Borden Co., Chicago, Ill. January 1-March 31, 1957: net profit, $4,640,986, equal to 98¢ a share, against $4,030,000, or 86¢ a share, in the 1956 period; sales, $221,701,044, against $203,325,569.

U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. Three months to March 31, 1957: net loss, $28,541, contrasted with net profit of $52,293 in the 1956 quarter.

Allied Chemical & Dye Corp., New York, N. Y. First quarter, 1957: net earnings, $10,007,199, equal to $1.01 a capital share, against $12,737,852, or $1.28 a share, a year earlier; sales, $165,854,697, against $166,042,697.

American Hard Rubber Co., New York, N. Y. Twelve weeks ended March 24, 1957: consolidated net profit, $351,883, equal to $1.00 a common share, compared with $399,184, or $1.14 a share, in the 1956 period; net sales, $7,074,839, against $6,829,122.

American Zinc, Lead & Smelting Co., Columbus, O., and wholly owned subsidiaries. Initial quarter, 1957: net income, $585,665, equal to 50¢ a share, against $689,969, or 59¢ a share, in the like period last year; sales, $18,052,888, against $18,776,705.

Anaconda Wire & Cable Co., New York, N. Y. Three months ended March 31, 1957: net profit, $1,755,684, equal to $2.08 a share, compared with $2,644,205, or $3.13 a share, in the first quarter last year.

The Armstrong Rubber Co., West Haven, Conn., and wholly owned subsidiaries. Six months ended March 31, 1957: consolidated net profit, $984,214, equal to 63¢ each on 1,553,888 common shares, compared with $854,869, or 55¢ a share, in the corresponding months of the preceding year; net sales, $31,998,761, against $28,906,239.

Belden Mfg. Co., Chicago, Ill. Three months to March 31, 1957: net profit, $422,745, equal to $1.08 a share, against $481,148, or $1.24 a share, in the '56 quarter.

Sidney Blumenthal Co., Inc., New York, N. Y. Quarter ended March 31, 1957: net loss, $140,605, contrasted with net profit of $145,598 in the same period last year.

Celanese Corp. of America, Charlotte, N. C., and domestic subsidiaries. March quarter, 1957: net profit, $2,912,820, equal to 30¢ a common share, compared with $3,461,766, or 39¢ a share, in the 1956 quarter; net sales, $46,852,931, against $48,477,887.

Columbian Carbon Co., New York, N. Y., and subsidiaries. Quarter ended March 31, 1957: net earnings, $1,631,838, equal to $1.01 each on 1,612,218 capital shares, against $1,761,453, or $1.09 a share, in the corresponding period last year; sales, $19,331,542, against $16,756,550.

Liquid Carbonic Corp., Chicago, Ill. Six months to March 31, 1957: net income, $1,365,815, equal to $1.17 a common share, compared with $847,604, or 75¢ a share, in the 1956 months; sales, $16,411,388, against $14,815,521.

Collins & Aikman Corp., New York, N. Y. Fifty-three weeks ended March 2, 1957: net loss, $1,576,877, contrasted with net profit of $981,361 in the year ended February 25, 1956.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., and consolidated subsidiaries. First three months, 1957: net income, $98,897,480, equal to $2.12 a common share, against $94,919,549, or $2.03 a share, in the 1956 months; sales, $509,446,536, against $468,421,876.

Flintkote Co., New York, N. Y., and subsidiaries. Three months ended March 31, 1957: net profit, $943,129, equal to 59¢ a common share, compared with $778,279, or 51¢ a share, a year earlier; net sales, $24,615,916, against $23,308,340.

General Motors Corp., Detroit, Mich. Three months to March 31, 1957: net earnings, $261,357,742, equal to 93¢ a common share, compared with $282,593,355, or $1.01 a share, in the 1956 months.

Goodyear Tire & Rubber Co., Akron, O., and subsidiaries. Initial quarter, 1957: net profit, $17,265,055, equal to $1.66 each on 10,362,319 capital shares, compared with $13,418,897, or $1.29 a share, a year earlier; net sales, $353,178,571, against $335,270,426.

Mansfield Tire & Rubber Co., Mansfield, O. First quarter, 1957: net earnings, $214,694, equal to 32¢ a common share, compared with $309,202, or 49¢ a share, in the first quarter of 1956; sales, $13,041,986, against $14,794,483.

Minnesota Mining & Mfg. Co., St. Paul, Minn., and domestic and Canadian subsidiaries. March quarter, 1957: net profit, $9,762,181, equal to 58¢ a common share, against $8,704,518, or 52¢ a share, a year earlier; net sales, $89,475,428, against $75,706,190.

Mt. Vernon Mills, Inc., New York, N. Y. January 1-March 31, 1957: net earnings, $143,000, equal to 19¢ a share, compared with $410,000, or 63¢ a share, a year earlier.

National Automotive Fibres Co., Trenton, N. J. First quarter, 1957: net income, $553,791, equal to 51¢ a share, compared with $258,118, or 24¢ a share, a year earlier.

Phillips Petroleum Co., Bartlesville, Okla., and subsidiaries. First quarter, 1957: net earnings, $28,379,430, equal to 83¢ a share, against $28,332,238, or 83¢ a share a year earlier.

Pittsburgh Plate Glass Co., Pittsburgh, Pa. First quarter, 1957: net earnings, $13,226,292, equal to $1.34 a share, compared with $15,704,776, or $1.59 a share, a year earlier.

National Rubber Machinery Co., Akron, O. First quarter, 1957: net income, $184,000, equal to 94¢ each on 195,556 capital shares, compared with $174,000, or 89¢ a share, in the corresponding period last year; sales, $3,894,000, against $2,759,000.

The New Jersey Zinc Co., New York, N. Y., and subsidiaries. First three months, 1957: net income, $1,177,218, equal to 60¢ a share, against $1,175,475, or 60¢ a share, in the 1956 months; net sales, $5,740,864, against $5,659,414.

Nopco Chemical Co., Harrison, N. J., and subsidiaries. January 1-March 31, 1957: net profit, $377,772, equal to 75¢ each on 492,238 common shares, against $358,982, or 71¢ a share, in the similar months last year; sales, $6,690,962, against $6,417,557.

Raybestos-Manhattan, Inc., Passaic, N. J. First quarter, 1957: net profit, $909,450, equal to $1.45 a share, compared with $1,078,460, or $1.72 a share, a year earlier.

J. O. Ross Engineering Corp., New York, N. Y. For 1956: consolidated net earnings, $1,239,564, compared with $882,127 in 1955; sales, $30,321,227, a record figure.

Shell Oil Co., New York, N. Y., and wholly owned subsidiaries. Initial quarter, 1957: net earnings, $41,449,505, equal to $1.37 each on 30,286,384 capital shares, compared with $35,010,360, or $1.16 a share, in the like period last year; sales, $467,198,691, against $403,312,973.

Sheller Mfg. Corp., Portland, Ind., and subsidiaries. March quarter, 1957: net income, $591,294, equal to 62¢ a capital share, against $573,309, or 60¢ a share, in the first three months of 1956; net sales, $11,875,676, against $12,194,583.

Sun Oil Co., Philadelphia, Pa. First quarter, 1957: net income, $13,331,110, equal to $1.24 a share, against $12,255,231, or $1.21 a share, in the like period last year.

Thiokol Chemical Corp., Trenton, N. J. Quarter ended March 31, 1957: net profit, $298,505, equal to 62¢ each on 484,299 capital shares, compared with $156,874, or 41¢ each on 386,730 shares, a year earlier.

The Timken Roller Bearing Co., Canton, O. First quarter, 1957: net earnings, $6,399,672, equal to $2.64 a share, against $6,897,998, or $2.85 a share, in the first quarter of 1956.

United States Rubber Co., New York, N. Y. Initial quarter, 1957: net profit, $8,179,761, equal to $1.25 a common share, compared with $9,103,348, or $1.41 a share, in the like period last year; net sales, $232,224,961, against $229,649,654.

News from Abroad

Spain

Ethylene Glycol-NR Mixes

The favorable effect produced by the addition of ethylene glycol to natural or synthetic rubber compounds containing silicic anhydride as filler has already been noted by different authors. Similar results are also obtainable with other fillers, the Spanish investigators, J. Royo Martinez and A. Garcia Vargas[1] found after numerous tests.

Using a basic mix of 100 parts, by weight, of smoked sheet, 0.75 mercapto benzo thiazole (MBT), 1 phenyl-β-naphthylamine, 3 ZnO, 2 stearic acid and 3 sulfur, they added inert and semi-active fillers in the proportion of 45 cubic centimeters per 100 grams of rubber, and active white fillers and carbon black, in the proportion of 30 cubic centimeters per 100 grams of rubber. Two series of compounds were prepared, A and B, respectively, the former including 2% (by weight) of ethylene glycol. Plasticity and prevulcanization time were measured for each crude mix. Samples were cured at 143° C for 5, 10, 15, 20, 25, and 30 minutes (except in the case of some fast-curing samples), and dynamometric properties tested.

The white fillers used were calcium carbonate (Spanish White), two types of calcium magnesium carbonate, magnesium carbonate, kaolin, aluminum silicate anhydride (Pigment 33),[2] and Calsil.[3] In general, the result of the addition of ethylene glycol in the white mixes was to accelerate cure and improve values for modulus and breaking load, the most marked effect was observed in the Spanish White compounds. At the other extreme, the A mixes with magnesium calcium carbonate showed no appreciable improvement. The A mixes with aluminum silicate anhydride cured much faster than the corresponding B mixes, but otherwise significant improvement was noted only in the values at modulus of 500%. The difference in the rate of cure of A and B mixes with Calsil was smaller, but improvement in dynamometric values was more pronounced.

For the studies on carbon black mixes, three series of A and B mixes were prepared using MT, SRF, and EPC blacks, respectively. Only EPC samples benefited substantially by the inclusion of ethylene glycol; the latter counteracted the well-known retarding action of the channel black; curing times were cut, and the resulting vulcanizates had excellent mechanical properties, superior to those of the corresponding B mixes.

Aging characteristics were not adversely affected by the ethylene glycol, a series of tests of kaolin revealed. For tests designed to show the behavior of ethylene in mixes accelerated with Santocure,[4] NOBS,[5] Vulkacit 3, Vulkacit P Extra N,[6] and Thiuram M,[7] a magnesium carbonate compound was used as base. The only mixes not improved by the glycol were those containing Thiuram M (without addition of sulfur); the other samples all showed some good effects. In the case of Santocure and NOBS, the presence of the glycol led to excessive acceleration, accompanied however, by a slight improvement in mechanical properties; vulcanization plateau was even wider than is usual with these accelerators. It is suggested that a combination of ethylene glycol and these accelerators might be worth trying, with the proportion of the latter suitably reduced—the glycol compensating for any retardation caused by reducing the accelerator.

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[1] *Rev. de Plasticos,* Sept.-Oct., 1956, p. 259.
[2] Moore & Munger, New York, N. Y., U.S.A.
[3] Wilfred Smith, Ltd., London, England.
[4] N-cyclohexyl-2-benzothiazole sulfenamide, Monsanto Chemical Co., Akron, O., U.S.A.
[5] Mixture N-oxydiethylene-2-benzothiazole sulfenamide and benzothiazoyl disulfide, American Cyanamid Co., Bound Brook, N. J., U.S.A.
[6] Zinc ethyl-phenyl dithiocarbamate, Fabriken Bayer, Leverkusen, Germany.
[7] Tetramethyl thiuram disulfide, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

France

NR-Mica Tire Inner Liners

A good deal of research on tubeless tires has centered on efforts to provide them with relatively airtight inner linings to reduce rate of deflation and thereby improve road-holding qualities and prolong tire life, as well as to eliminate the risk of air penetrating under pressure, with resulting separation of the plies of the carcass. At the Institute Français du Caoutchouc, P. Thirion and R. Chasset[1] studied the effect of mica in natural rubber compounds for these linings.

Two grades of powdered mica, A (dry grind) and B (wet grind), were used. Earlier tests had indicated that in practice it is not advisable to exceed a proportion of 20% (volume) of mica on the rubber, since permeability decreases much more rapidly with low or moderate amounts of mica, and this ratio was employed for linings of a small series of tubeless tires 6.70 x 15, produced on a pilot scale. No difficulty in processing was experienced; indeed calendering was easier than with natural rubber and reclaimed butyl rubber compounds. The tires with the mica-mix linings performed satisfactorily in severe speed track tests as well as in a 4,000-kilometer road test. It is admitted, however, that only long-time tests covering the entire period of normal wear of a tire will permit definite conclusions on the prospects for natural rubber-mica powder mixes for lining the interior of tubeless tires.

Meanwhile it was found that the permeability of the two mica mixes selected was two to four times lower than that of the usual natural rubber mixes so that constant pressure and less risk of plies separating are assured. The mechanical properties of the mica compounds are considered sufficient to permit the linings to outlast the tread. In view of the good adhesion of the mica compounds to the carcass, the low tear strength due to the presence of the mica is not important. The addition of a plasticizer, moreover, substantially increases resistance to flex cracking.

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[1] *Rev. gén. caoutchouc,* Feb., 1957, p. 131.

Netherlands

Another Synthetic Plant?

Holland is likely to become the next European country to produce synthetic rubber, judging from the report of a *Financial Times* correspondent. According to this source, Royal Dutch Petroleum, which has a large oil refinery at Pernis, near Rotterdam, is contemplating establishment of a large plant to produce synthetic rubber based on petroleum derivatives, in the same locality.

Dutch manufacturers are said to be using increasing amounts of synthetic rubber; it already accounts for 15% of their total rubber consumption, and the proportion is expected to go still higher in view of the stable price of the synthetic product and doubts as to the possibility that natural rubber outputs could be stepped up quickly enough to meet growing world demand.

Rubber Roads in Europe

A report[1] on rubber roads on the European continent has recently been made by A. F. W. Wildeboer, European road expert and former road consultant to Rubber Stichting, Delft. He examined roads in Holland, Germany, Switzerland, Austria, Denmark, Sweden, and Finland and in the main found that stretches using rubber outlasted control stretches without rubber. For example, the three oldest rubberized roads on the Continent, laid in Holland 20 years ago, are still in excellent condition, whereas adjacent control stretches without rubber have had many times their initial cost spent on them for repairs.

In Germany, stretches of rubber asphalt surfacing on roads, pontoons, and ware-

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[1] *Rubber Developments,* 10, 1, 12 (1957).

house floorings in Frankfurt a.M., Cologne, and Hamburg all show marked superiority. Mr. Wildeboer was particularly impressed by a stretch on the arterial highway near Oberhausen in the Ruhr district, now three years old. In Frankfurt, 28 test sections were laid over cobble pavements between 1951 and 1952; only one of these was rubberized, and it is now the only one still in perfect condition. Similar results were observed in the other countries.

The superior showing of rubber and asphalt, Wildeboer found—on the basis of samples extracted from the road—to be due to remarkable improvement in stability at high temperatures (40° C.) over the same mixtures without rubber; furthermore impact resistance at 0° C. also showed an improvement of between 20 and 55%; all this is ascribed to the better cohesion in the bitumen and the lower heat sensitiveness of rubberized bitumen.

The "really astonishing difference in aging in favor of rubber" Wildeboer believes may be the result of "molecular rearrangement due to temperature changes, especially in thin layers where the rubber prevents the bitumen from hardening"; this difference in aging explains why the other improvements in the properties of the binding medium are retained so much better and keep the road in its original laying condition much longer, thereby extending its total life considerably.

Malaya

Packers' Group Talks Claims with RTA, London

Invited by the Rubber Trade Association of London and manufacturers' associations in the United Kingdom, an all-Malayan trade delegation was scheduled to arrive in London late in May to discuss grading and quality claims with British rubber manufacturers. The delegates, including representative of the Rubber Trade Association of Singapore, the Singapore Chamber of Commerce Rubber Association, the Federation, the Federation of Rubber Associations of the Federation of Malaya, and the United Planters' Association of Malaya, as well as representatives of a number of rubber packers, will be headed by C. F. Smith, who is the chairman of the Malayan Rubber Export Registration Board.

They will investigate the conditions leading to what packers criticize as unjustified claims and will see how Malayan rubber is sampled and handled by factories, and will also learn about the arbitration procedure of the Rubber Trade Association of London.

In this connection, the recently published opinion of the Malayan Rubber Export Registration Board on Malayan packing standards, as it recently appeared in a Malayan paper, is of interest. The Board, it seems, has come to the conclusion that the standard of rubber packing in the Federation and Singapore is high and compares favorably with that of other countries. Only a comparatively insignificant tonnage was the subject of complaints during 1956; in all 204 complaints were received involving only 0.55% of the total shipments for the year. Of the complaints, 197 came from the Rubber Trade Association of London, and others came from Japan and New York. Fines were imposed in 17 cases. Packers have sharply criticized complaints by the London organization, and some complaints were found to be unjustified; others, the board considered, could have been settled in day-to-day business. In some cases no action was taken.

The Board, however, did not omit to add to its good opinion the suggestion that there should be no relaxation of efforts to continue to improve quality so as to provide no occasion for future complaints.

Blackman Says More Funds Needed for NR Research

The report of the group of British experts headed by Prof. G. E. Blackman, of Oxford, who last year investigated the rubber industry of Malaya, is still being kept secret. It is known, however, that it includes a recommendation to raise the rubber research and development cess from ½-cent (Straits currency) to ¾-cent, a pound, to cover the cost of work aiming at improving cultivation and processing techniques, higher salaries for research workers to attract good men, and increased research, all to make natural rubber more competitive with synthetic rubber. The suggestion to raise the cess is expected to be strongly opposed by European companies which are already carrying out research programs of their own, while at the same time contributing to the existing cess; Asian producers, however, are understood to be in favor of the higher levy.

The Rubber Producers' Council is asking for views on the report from the Rubber Growers' Association, the United Planting Association of Malaya, the Malayan Estate Owners Association, and the Council of Smallholders.

Footwear Manufacturing Industry Has Problems

In 1956, factories in Malaya produced 9,739,000 pairs of footwear, wholly or partly of rubber, an official report states. Rubber-soled canvas shoes were most in demand; next came slippers with velveteen or rubber tops. Although local footwear manufacture has expanded, and imports have declined proportionately, about 15% of local consumption must still be satisfied by overseas products.

The industry here is highly competitive and on the whole does not seem to be well organized; many factories seem to be run in an erratic fashion., with frequent starts and stops in production. Apparently this is due to the fact that too often excessive reliance is placed on export business, while at the same time proper measures to secure regular outlets for export sales have not been taken; the report states that sometimes up to 50% of output is intended for export.

The production of foamed latex seems to be in a relatively better position; at any rate, output which was 49,000 pounds in 1954 rose to 82,000 pounds in 1956, and a further increase is looked for in 1957.

Japan

NR Importer-Manufacturer Delegation Visits Malaya

A ten-man mission of Japanese rubber importers and manufacturers was scheduled to leave Japan on May 9 to visit Singapore, the Malayan Federation, and Indonesia. The mission will inspect rubber industries in Singapore and Indonesia and discuss ways to improve trade with Japan.

While a number of shippers in Singapore have already agreed to the Japanese proposal on arbitration in Tokyo instead of Singapore, it seems that the Rubber Trade Association of Singapore has not found it acceptable. This, then, will be one of the matters the mission will try to iron out; it will also endeavor to persuade shippers in Indonesia to agree to commercial arbitration in Tokyo instead of Singapore.

Indonesia

Far Eastern Producers Confer on NR Policy

Headed by the deputy chief of the foreign economy department of Indonesia, Dr. Yusof Ismail, a group of six Indonesian rubber men visited Malaya early in April to consider plans to stabilize the price of rubber. They met representatives of the government and rubber producers from Singapore and the Federation, in Kuala Lumpur, where discussions were held on the stand to be taken when the International Rubber Study Group convenes in Jogjakarta, Java, on June 24.

What was decided during these talks was not revealed, though Dr. Ismail did hint that French consumers had suggested a secret plan to combat the threat of synthetic rubber.

Germany

Isotopes Used to Control Rubber Coatings Thickness

Isotopes are being employed by the Continental Gummi Werke A.G., Hannover, to control the thickness of the rubber layer on rubberized fabrics. Apparently the present high speed of calendering, now 50 m/min., helps make this method of insuring uniform rubber coatings particularly advantageous.

NEW MATERIALS

High Carbon Black-Loaded Polyethylene

Polyethylene materials containing 50% and more of carbon black have been announced by Godfrey L. Cabot, Inc., Boston, Mass. Designated CAB-XL polyethylene compositions, they are said to be derived from certain polymers using various loadings of carbon black and other finely divided fillers in combination with unrevealed chemical cross-linking agents. The relatively high loading of carbon black, previously regarded as impossible of achievement, has virtually overcome two of the most serious limitations of plastics, creep and fracture, according to the company. CAB-XL polyethylene compositions are reported to maintain their rigidity and resistance to pressure even at high temperatures, and remain flexible even at extremely low temperatures.

Polyethylene pipe, continuously fabricated using a CAB-XL composition containing 100 parts of carbon black, was said to have exhibited such an unusual combination of properties as resistance to stress cracking, a marked improvement in high-temperature behavior virtual elimination of plastic flow, and improved resistance to deterioration by solvents and oils. Also, tests indicated that burst strength had been doubled both at room temperature and elevated temperatures. Costs of the pipe was substantially lowered. Similar results were achieved with wire coverings.

Evaluation of various combinations of polymers and carbon black is being continued by Cabot. While supplying the following basic properties of CAB-XL polyethylene, the company cautions that these test data should not be considered as the maximum properties attainable.

Stress at yield, psi	2,000–3,600
Stiffness modulus, psi. @ 20° C	40,000–110,000
Brittleness temp. (flex)	passes —50 to —76° C.
Gasoline absorption, 20 days (% weight gain)	4–10%
Volume swelling, xylene 24 hours @ 80° C	250–500%
Xylene extractable 24 hours @ 80° C	10–20%

Accelerator NA-33 for Type W Neoprene

A delayed-action accelerator particularly suited for use with the W types of neoprene has been announced by E. I. du Pont de Nemours & Co., Inc., elastomer chemicals department, Wilmington, Del. Designated NA-33, it is said to provide a hitherto unobtainable balance between processing safety and cure rate. The W types of neoprene (W, WX, WRT, and WHV) accelerated with NA-33 are reported to be fast curing, very safe processing, and have vulcanizate properties comparable to those produced with another Du Pont accelerator, NA-22. NA-33 can also be used as an accelerator in neoprene latex compounds, producing films which have high modulus and low permanent set.

NA-22 was previously recommended for use with the W types of neoprene in order to obtain the fullest development of the excellent vulcanizate properties inherent with these types. The W types are much more stable in the raw state than the G types of neoprene, exhibit freedom from mill sticking, and in many respects give better vulcanizate quality. NA-22 has proved to be outstanding in producing fast-curing compounds and vulcanizates with exceptional resistance to heat and compression set.

Du Pont points out, however, that in certain stocks, particularly those that are hot-running, it has been considered marginal in the degree of processing safety that it provides. With NA-33, the company says, the compounder may now use the W types of neoprene with practical assurance of trouble-free processing, without significant sacrifice in vulcanizate properties.

A greyish-white crystalline thioamide powder, NA-33 has a specific gravity of 1.12, a melting point not lower than 102° C., and an excellent storage stability, according to Du Pont. It is recommended that 0.5 to 1.5 PHR be used in compounding.

Union Carbide K-1014 Silicone Rubber

A silicone rubber compound that exceeds U. S. Navy Shipboard Cable Specification MIL-C-2194B for coated glass tapes with high dielectric strength, high crease resistance, and high moisture resistance has been announced by the silicones division of Union Carbide Corp., New York, N. Y. Designated K-1014, it is being marketed as either a 100% silicone solids compound or a 35% solids coating solution in toluene, either in catalyzed or uncatalyzed forms.

The soft, white solid compound is recommended for use in encapsulation of electrical components and in molding applications where ease of processing, low hardness, and reversion resistance, coupled with moderate physical strength and good electrical properties, are desired. This form is also useful as a low hardness, general-purpose molding stock.

The thick, white fluid form is recommended for coating of glass fabrics and tapes for electrical insulation, flexible hot-air ducting, hoses, harnesses, for glass sleevings, for dip coating of electrical components, and for anti-adhesive coatings on molding rugs.

Conventional silicone rubbers used to coat glass fabrics are extremely susceptible to reversion when exposed to high temperatures under stress. K-1014 coated glass fabrics, cured in the conventional manner and then post-cured either 24 hours at 480° F. or one hour at 600° F. in a moving stream of air, are completely resistant to reversion, the company says.

A specific gravity at 25° C. of 1.31 and 0.99 for the compound and the coating solution, respectively, is reported. Flash point of the coating solution is 75° F; while its average viscosity is 15,000 cps.

Test data and suggestions for compounding K-1014 are contained in an eight-page bulletin available from Union Carbide.

Pliovic S50 Low-Viscosity PVC Resin

A low-density, general-purpose, unmodified polyvinyl chloride resin has been announced by The Goodyear Tire & Rubber Co., chemical division, Akron, O. Designated Pliovic S50, it has an inherent viscosity of 0.68, imparting to compounds based upon it such reported processing advantages as superior plastic flow properties, ability to be processed 50° F. lower than the average molecular weight resins, and easy processing without plasticizers.

Suggested applications for Pliovic S50 include blending with higher molecular weight resins, vinyl-asbestos flooring, high-fidelity phonograph records, injection molded items, rigid extrusions and moldings, semi-rigid calendered goods, nitrile rubber combinations, and replacement for copolymer resins.

A fine white powder, Pliovic S50 has a specific gravity of 1.40, a bulk density of 44 pounds per cubic foot, and an average particle size of 40 microns.

A one-page technical data sheet, Types and Properties Bulletin 57-105, describing the resin, is available from the company.

Vulcacure NS

A new liquid ultra-accelerator for use in both natural and synthetic latex compounds has been introduced by Alco Oil & Chemical Corp., Philadelphia, Pa. Designated Vulcacure NS, it is completely water soluble and can be used over a wide range of curing temperatures, from 70 to 300° F., producing both a high modulus and high tensile strength in latex rubber films. A liquid dithiocarbamate, the new accelerator has excellent aging characteristics, according to the company, and a low enough viscosity to insure uniform distribution throughout the latex.

ASRC-3110 for Chemically Blown Sponge

A styrene-butadiene rubber designed for use in the manufacture of chemically blown sponge of all types and colors has been announced by American Synthetic Rubber Corp., New York, N. Y. Designated ASRC-3110, it is the cold-rubber version of the old GR-S 1010 with what is said to be lower average raw polymer Mooney viscosity and superior tensile properties. According to available information, the designation 3110 is the first experimental code number assigned to producers of styrene-butadiene rubbers (SBR) which has so far been used (ASTM D 1419).

ASRC-3110 is a copolymer of butadiene and styrene manufactured by emulsion polymerization at 43° F., using a 50/50 blend of rosin acid and fatty acid soaps, a free radical-type activation system, and a carbamate shortstop. Coagulation is by the alum procedure. About 1.25% of a non-staining stabilizer has been added during manufacture. Bound styrene is put at 23.5%.

The rubber is produced so that its normal nature is to be soft, reducing materially the breakdown costs, the company says. Normally it is necessary to mill and otherwise masticate and plasticize a rubber to make it soft before making chemically blown sponge items so that a uniform cell structure and a good feeling sponge results.

Some physical properties of ASRC-3110 have been reported as follows:

Viscosity, raw polymer ML4 @ 212° F	25
Compound polymer ML4 @ 212° F	43
Properties of vulcanizate @ 77° F.	
50-minute cure @ 292° F.	
Tensile strength	3,100 psi.
Ultimate elongation	640%
Modulus @ 300% elongation	1,000 psi.

Technical data sheets on this new SBR are available from the company.

Hetron 33 Polyester Resin

A medium viscosity, semi-rigid type of polyester resin said to have excellent strength qualities is available in semi-commercial quantities from Durez Plastics Division of Hooker Electrochemical Co., North Tonawanda, N. Y. Called Hetron 33, it is recommended for use with glass fiber where good impact strength and flexural strength are required in combination. It is reported to be an excellent molding resin, especially for matched die molding. Laminates made from it are strong and stiff, resist impact cracking, are self-extinguishing, and can be baked at 350° F. for 90 minutes several times without cracking, according to the company.

Specific gravity of Hetron 33 is 1.27; SPI gel time is 5-6 minutes; Gardner-Holt viscosity is 13-17 poises.

G-E Silicone Rubber 81716

A high-strength silicone rubber meeting AMS 3345 requirements for airframes of tensile and tear strength, elongation, dry heat resistance, compression set, and low-temperature flexibility has been announced by General Electric Co., silicone products department, Waterford, N. Y. Designated 81716, the new compound will have such typical aircraft industry applications as diaphragms, boots and bellows, forming blankets, and seals for firewalls, bomb-bay doors, wheel and camera wells, hatches, windows, and canopies.

According to the company, 81716 also meets AMS 3345 values in three of four oil-resistance requirements and is marginal in the fourth, tensile strength after prolonged immersion in hot lubricating oil. The new silicone rubber is said to be as strong as or stronger after immersion than most silicone rubber prior to oil exposure. This new material also can be extruded, calendered, and molded. Supplied with or without a catalyst, it may be cured by a variety of oven, hot air vulcanization, or steam cures. Currently 81716 is available only in limited quantities for evaluation.

Some typical properties of 81716 have been reported as follows:

Hardness, Shore A	51
Tensile strength, psi	1550
Elongation, %	625
Tear, p.i. (Die B)	180
Compression set, % (70 hrs. @ 300° F.)	60

Nacconate 310 Diisocyanate

Dimethyldiphenylmethane diisocyanate is being made available in developmental quantities by National Aniline Division, Allied Chemical & Dye Corp., New York, N. Y. Designated Nacconate 310, it is a light cream-colored crystalline solid that is said to possess unusually low reactivity, having a methyl group ortho to each of the isocyanate groups.

Comparatively stable aqueous emulsions of the diisocyanate can be readily prepared, according to the company. These emulsions are useful in treating various textile fibers and fabrics. Combined with polyester and alkyd emulsions, they are believed to be valuable as textile and paper impregnants where water-proofing and abrasion resistant properties are desired. Another use for Nacconate 310 is as a curing agent for urethane elastomers and plastics, where its low vapor pressure is an important advantage.

Technical Bulletin I-17F, giving an infrared spectrogram of Nacconate 310, vapor pressure curve, and a reactivity chart, is available from the company.

Polyurethane Foam Cross-Linking Agent

Octakis (2-hydroxypropyl) sucrose, a newly developed chemical said to have excellent utility as a cross-linking agent for polyurethane foams prepared from polyglycols, has been announced by Dow Chemical Co., Midland, Mich. Designated Hyprose SP80, it is a viscous, yellowish-amber liquid prepared by the reaction of sucrose with propylene oxide. As a cross-linking agent, it may be added after the prepolymer reaction to produce low-density foams with high load-bearing characteristics and good resiliency.

Other uses for Hyprose SP80 are as a plasticizer for cellulosic materials and for phenol-formaldehyde resins, and as emulsifiers and detergents in its fatty acid ester form.

Specific gravity of Hyprose SP80 is 1.160-1.180; viscosity of a 75% aqueous solution at 25° C. is 490-660 cps.

A technical bulletin on this new material is available from the technical service and development department of the company.

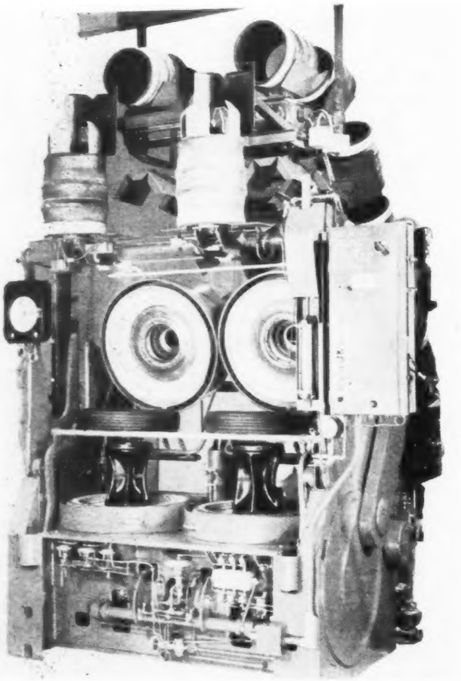
Modified Alkyl Phthalate Plasticizer

A new primary plasticizer for vinyl resins said to combine low-temperature flexibility and low volatility with excellent processing characteristics has been introduced by Pittsburgh Coke & Chemical Co., industrial chemicals division, Pittsburgh, Pa. Designated PX-313, it is a modified alkyl phthalate that is reported to impart low-temperature flexibility in vinyl equivalent to that obtained from the higher-cost n-octyl-n-decyl phthalates. PX-313 is also said to be an effective plasticizer for most synthetic rubbers, as well as an "outstanding" plasticizer for plastisols, to which it imparts good initial viscosity characteristics, excellent shelf life, and easy processing.

Some typical physical properties of PX-313 have been reported as follows:

Specific gravity, 25/25° C.	0.956
Refractive index, 25° C.	1.476
Pour point, °C.	−15
Flash point, °F.	435
Viscosity, cps., @ 25° C.	45.8
50° C.	15.1
75° C.	7.0

NEW EQUIPMENT



Model 230-40-11-½P Twin Tilt-Back Bag-O-Matic

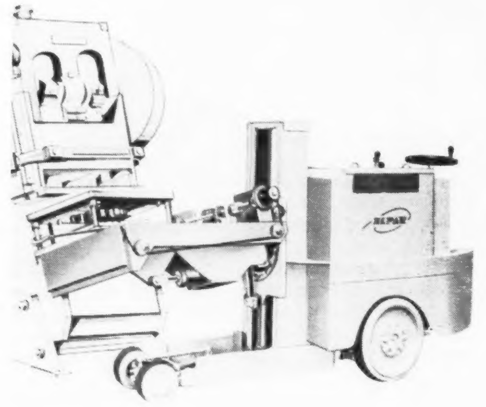
McNeil Automatic Bag-O-Matic

What is called the world's first completely automatic tire curing press has been announced by The McNeil Machine & Engineering Co., Akron, O. Called McNeil-Akron Model 230-40-11-½P Twin Tilt-Back Bag-O-Matic, it handles all passenger tires in rim diameters of 12 through 16 inches, and will accept cross-sections through the newer 9.50 or 10.00 sizes. Each press is timed for the minimum cure for that particular size of tire. Short, uniform cures are possible as the press is open for the minimum amount of time, allowing molds and bags to stay hot. Since the bag does not cool down as much between cures, its life is extended, the company says. A 10-15% production increase over manually operated installations is claimed for the new 40-inch Bag-O-Matic.

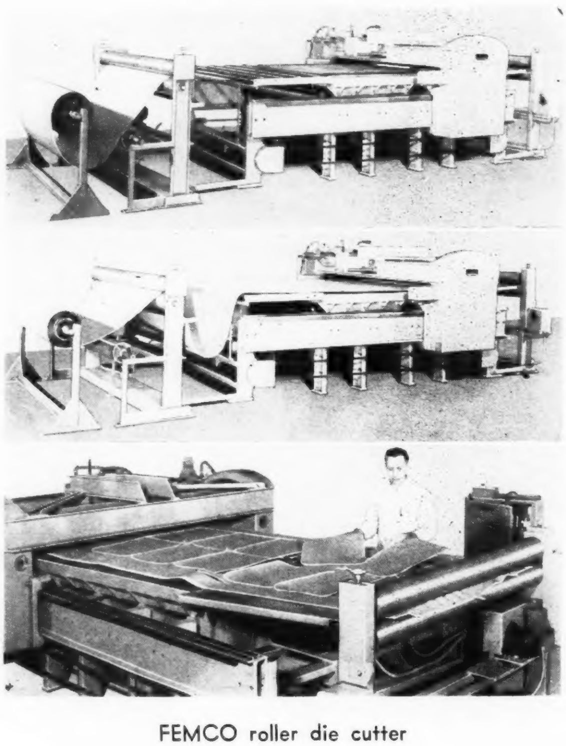
Die-Handler for Inclined Presses

A die-handling truck for removing or setting dies in medium-to-large inclined presses has been placed on the market by The Elwell-Parker Electric Co., Cleveland, O. Having a capacity of 5,000 pounds, the die-handler is built on the chassis of an electric-powered high-lift platform truck which is equipped with a rotating, tilting platform 44 inches long and 50 inches wide. By tilting the rear of the platform upward to match the angle of the press bed, dies can be pulled on to the platform over the end of the truck.

According to the company, if operating space or the shape of the die require side loading, the truck can be positioned alongside the press, and the platform rotated either to the right or left to match the angle of the press bed. Both the tilt and the rotate functions are actuated by double-acting hydraulic cylinders. The platform can be raised or lowered by means of a hydraulic lift cylinder to permit proper height alinement. In addition to operations on inclined presses, the truck can also be used for die handling in and out of standard horizontal presses.



Elwell-Parker's die-handler

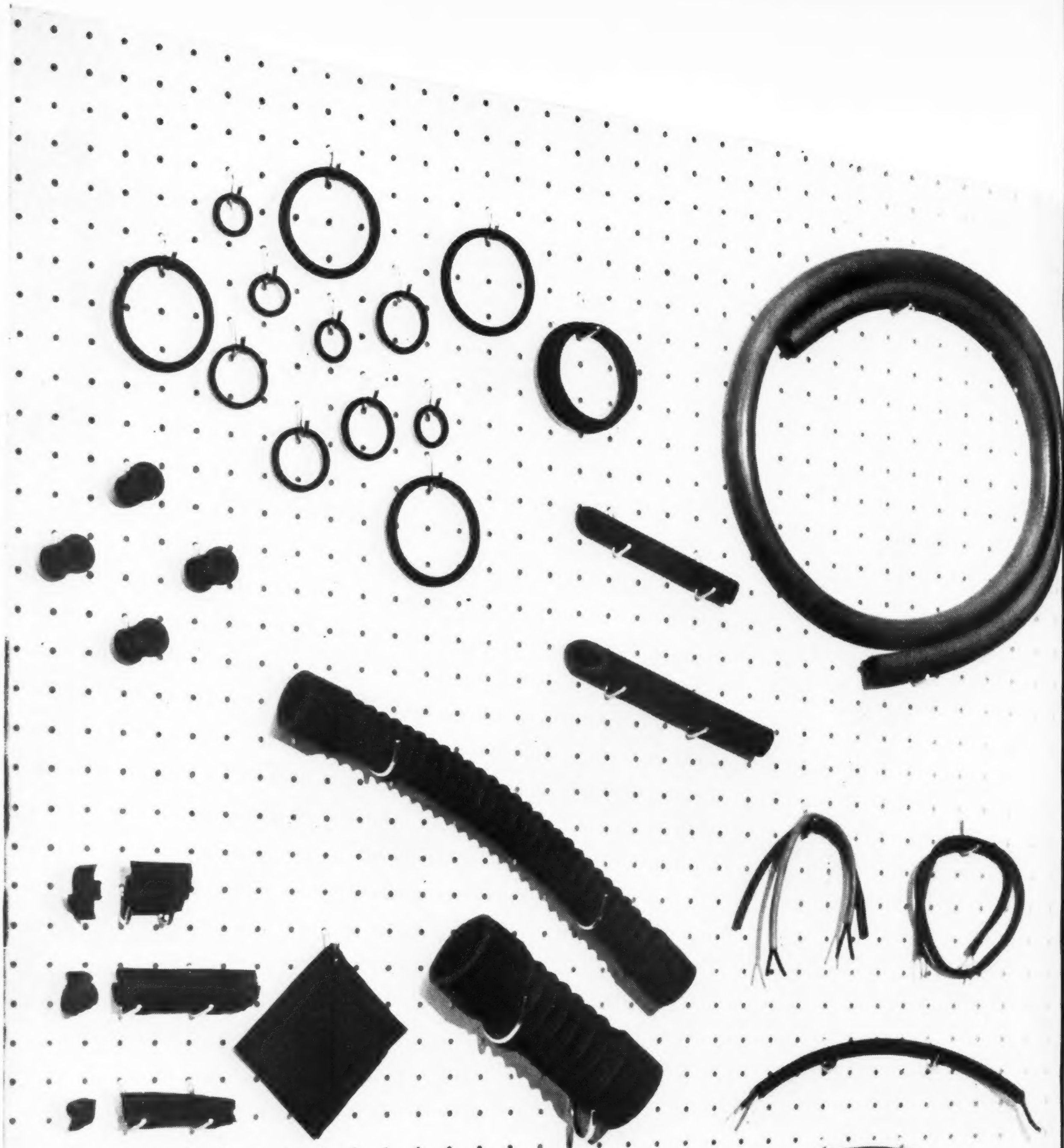


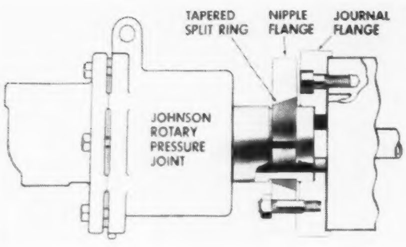
FEMCO roller die cutter

Automatic Roller Die Cutter

An automatic roller die cutter that will die cut parts from roll stock in a continuous operation is being manufactured by Falls Engineering & Machine Co., Cuyahoga Falls, O. As shown in the illustration, the unit is equipped with two roll let-off supports from which roll stock is fed between two 72-inch power-driven pinch rolls. These pull a predetermined length of stock from the supply roll, allowing it to fall in a festoon fashion until it trips a switch which sets the die cutting portion of the machine in operation. Speed of the die cutter is preset by the operator. The machine will operate automatically until the entire roll of stock has been die cut.

The new die cutter has a 72- by 66-inch bed. A larger model is scheduled to go into production soon.





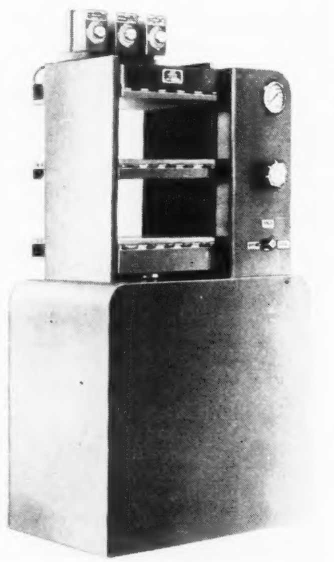
"Q" nipple

Nipple for Johnson Joints

A new quick-release nipple has been developed by Johnson Corp., Three Rivers, Mich., for use with the company's rotary pressure joints, employed on rubber mills and other equipment to admit steam or liquids under pressure to rotating rolls or drums. Called "Q" nipple, it is said to simplify the task of connecting joints to journals of such machines. Consisting of three parts— a journal flange, a tapered split ring, and a nipple flange—the new nipple is said to need only a simple wrench for installation or removal of the joints, in contrast to threaded nipples, often damaged by the use of heavy pipe wrenches. The "Q" nipple is furnished for all types of Johnson joints, which come in sizes from 1/4-inch to eight inches, for pressures up to 250 psi.

New Atlas Hydraulic Presses

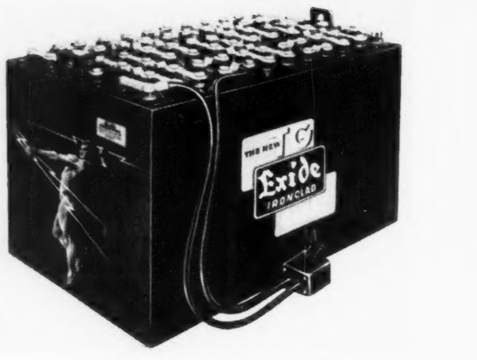
A new hydraulic press designed for the precision molding of rubber and plastics has been announced by Atlas Hydraulics, Inc., Philadelphia, Pa. Intended for both production and laboratory use, the new press is made with 14- by 14-inch electrically heated thermostatically controlled platens and is completely self-contained with the hydraulic pressure aggregating 75 tons capacity. A new hydraulic pump allows constant pressure on the platen area for any length of time without personal attention. Built with slab sides, the presses have no strain bolts, no nuts to adjust, and are permanently aligned. The rams are machined and chrome plated.



Atlas Press Model 150-33

Two models of the new Atlas Press are available: Models 150-22 and 150-33, with two and three platens, respectively. Model 150-22 has a six-inch daylight opening; while Model 150-33 has two three-inch daylight openings. Other reported specifications of the Atlas press are the following: ram stroke, six inches; ram diameter, 6½ inches; ram closing speed, 50 ipm.; gravity ram return; operating pressure, 1,000-4,500 psi.; and temperature range, 150-550° F. Model 150-22 weighs about 1,250 pounds, is 54 inches high, and occupies 32 by 18 inches of floor space. Model 150-33 weighs about 1,400 pounds, is 57 inches high, and also occupies 32 by 18 inches of floor space.

The two presses can also be made available in capacities up to 250 tons, ram diameters up to 12 inches, water cooled platens, larger daylight openings, longer ram strokes, and in higher temperature ranges.



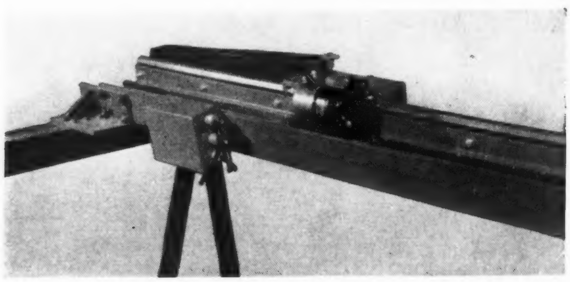
TG Exide-Ironclad Giant

New Industrial Truck Storage Battery

A new electric industrial-truck storage battery that is said to have the highest ampere-hour per cubic-inch rating on the motive power market has been introduced by Exide Industrial Division of Electric Storage Battery Co., Philadelphia, Pa. Designated TG Exide-Ironclad Giant, the new 21-plate battery cell has 120 more ampere-hours at the six-hour discharge rate than the company's TH Exide-Ironclad battery cell of the same size. The 246 watt-hours advantage of the new cell was accomplished while adding only six pounds to the total weight, it is said.

Said to be chiefly responsible for the forward stride is the development of new armored porous tubing which encases the Silvium grid spines and active material of the positive plates of the TG model. Each of these tubes consists of a perforated plastic casing enclosing a woven glass-fiber cylinder. The tubing is highly permeable to the diffusion of electrolyte and the passage of the current and is particularly effective at high discharge rates. It permits no loss or shredding of active material, the company declares, thus making more efficient use of the space within the battery. The tubing also has the required elasticity for holding the active material firmly in contact with the grid spines during battery cycling.

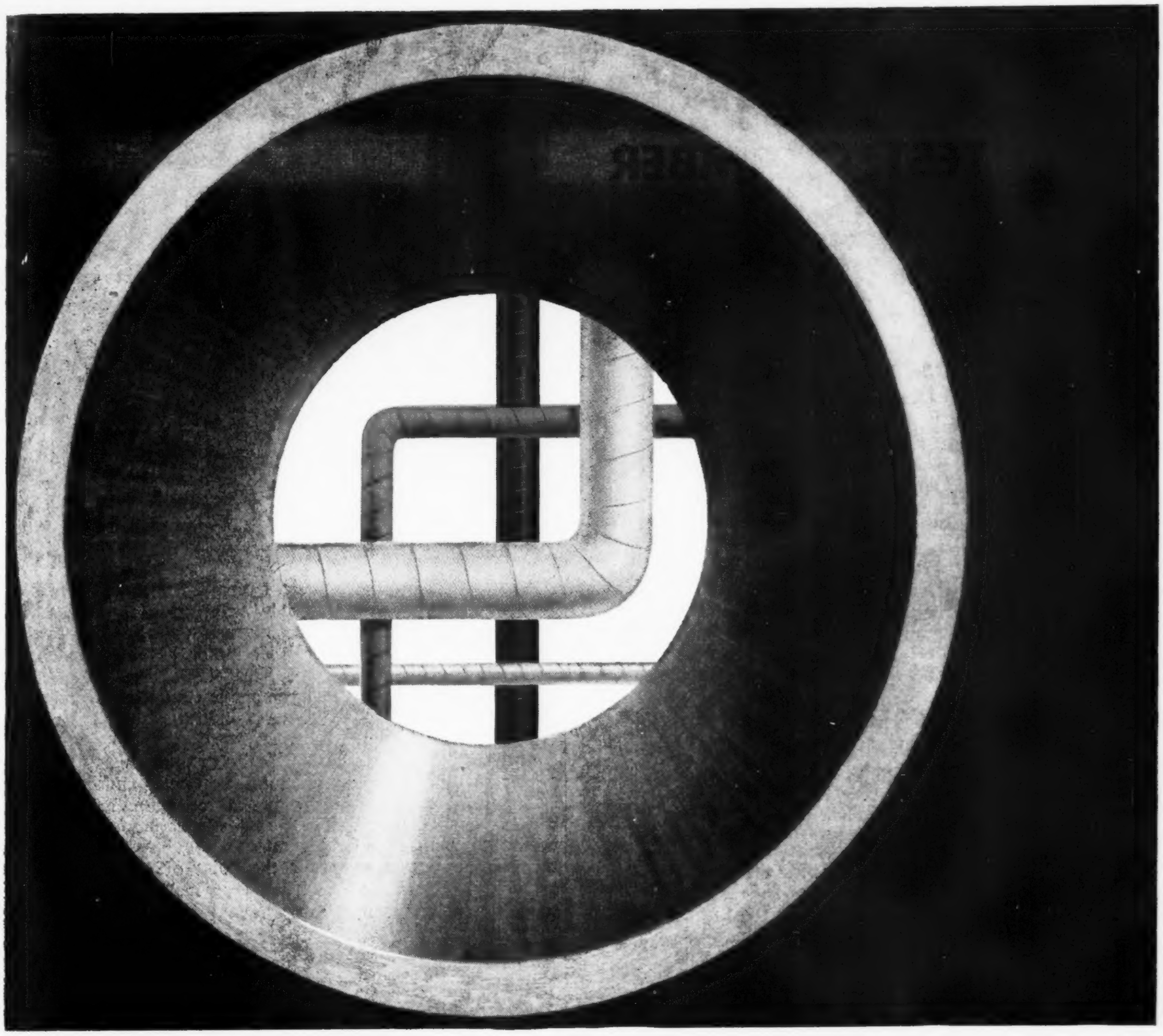
The TG Exide-Ironclad Giant battery is available in finished steel trays in 11 sizes, with from 11 to 33 plates; capacities range from 360 to 1,152 ampere-hours at the six-hour discharge rate. The new battery should provide many advantages to users of electric industrial trucks.



Tracerlab's Model T-6

Beta-Gage Mount Electric Drive

A new electric drive system has been announced by the industrial division of Tracerlab, Inc., Boston, Mass., for use with the company's "O" frame, "C" frame, or backscatter traversing or scanning beta-gage Mounts. Called Model T-6, the unit is said to afford completely automatic standardization, withdrawing the gage from the sheet and repositioning it on the sheet automatically on completion of the standardization cycle. It will also provide for measurement of a moving sheet at any point on the sheet, stopping and starting automatically and taking a reading at any spot for a preselected time. In addition, the unit can be used in hazardous areas should the gaging environment dictate, the company says.



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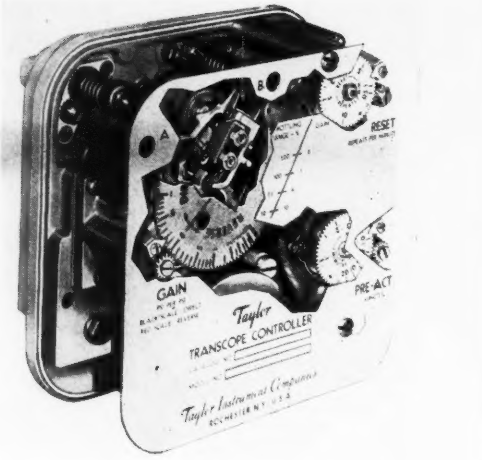


Taylor "Transcope" controller

Controller for Process Industries

A device for providing an extremely accurate means of maintaining a given set point by relaying measured variables for subsequent corrective action through a final control element such as diaphragm valve or lever motor has been announced by Taylor Instrument Cos., Rochester, N. Y. Called "Transcope," this six- by six- by 4½-inch pneumatic controller is said to be of special interest to the process industries, particularly the petroleum and chemical fields.

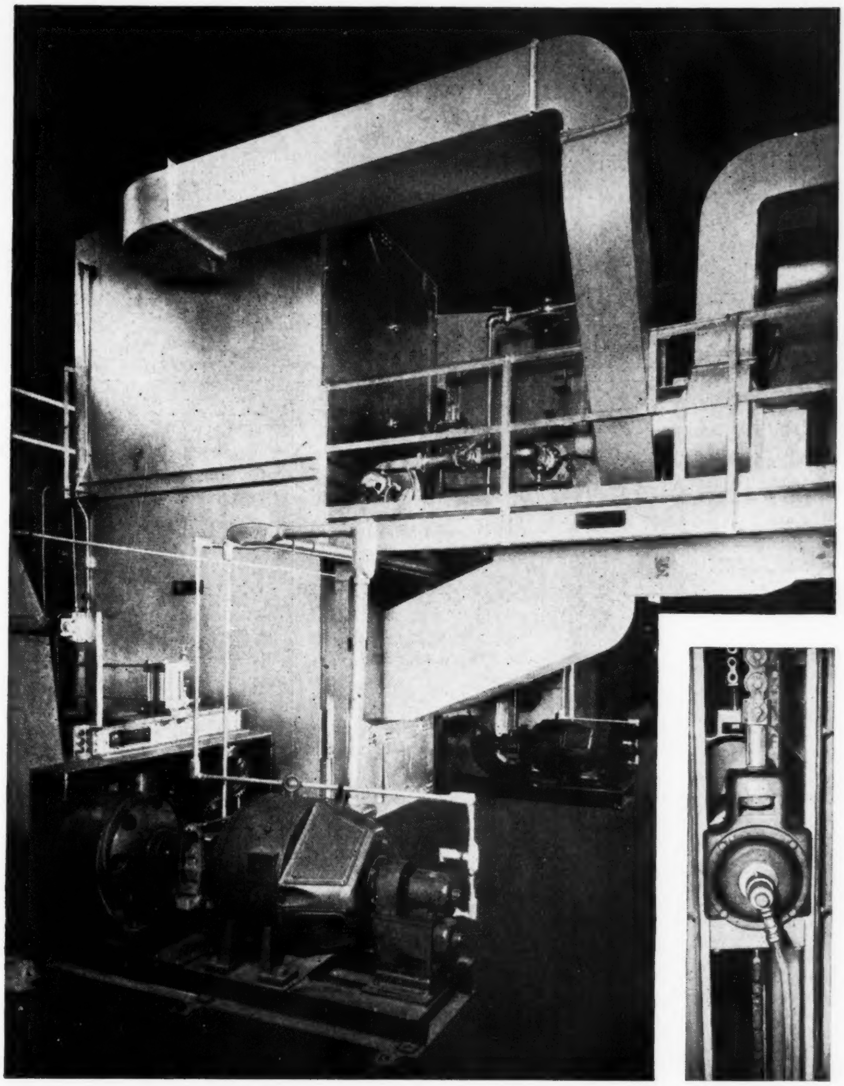
According to the company, this instrument makes use of the motion-balance principle through interconnected multiple bellows and springs acting on a common force plate. Primarily for back-of-panel board application, the plug-in feature makes possible mounting to a separate manifold located either at the point of measurement or the point of control. The unit has an integral cut-off relay. "Transcope" is available with single or multiple control responses.

Pouring Spout for Drums

A ten-gage sheet-metal pouring spout for steel or fiber drums containing powder, dry materials, or viscous plastics has been introduced by Sterling-Fleischman Co., Broomall, Pa. The spout is said to be easily installed and features a heavy locking band which operates on the over-the-center principle. The new equipment extends the pouring distance of the drum and gives plant operators greater control in pouring the material into reactors, mixers, and other equipment, according to the company. The spout was especially designed to make the company's one-man hydraulic drum lift more useful.

Sterling-Fleischman pouring spout and drum lift

"Let Tornqvist Make It." Tornqvist Co., Clifton, N. J. 12 pages. Services offered by the company, a custom metal fabricator, are outlined in this illustrated brochure. A wide variety of formed or welded metal parts and products can be made by the firm, whch includes many rubber and chemical companies among its clients.



Within the first day of startup, full width nylon tire cord processed in this 30-yard-per-minute, 14,000-pound-tension **IOI** Rollevator® Oven*, was made into aircraft tires meeting all qualification tests.

The Rollevator® roll automatically moves up and down within the oven, in direct relation to line speeds. Thus, at *any line speed*, heat-exposure time of the nylon is held *constant* at a constant temperature setting and at constant tension.

Rollevator® Oven* hot stretches nylon tire cord at constant optimum temperature, constant time and constant tension, at variable line speeds

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NEW PRODUCTS

DeLuxe Super Champion Tire

What is termed a high-performance, low-price tire has been added to the passenger-car tire line of The Firestone Tire & Rubber Co., Akron, O. Called DeLuxe Super Champion, this replacement tire is said to incorporate the following rubber stock: a heat-resistant tread compound composition used to reduce oxidation and deterioration; a "newly discovered synthetic rubber" for high adhesion qualities; and a layer of high adhesion stock between the fourth ply and tread to eliminate separation. Available in most passenger-car sizes, the new tire has a narrow white sidewall and an anti-scuff bumper.

Sun Rubber Crying Dolls

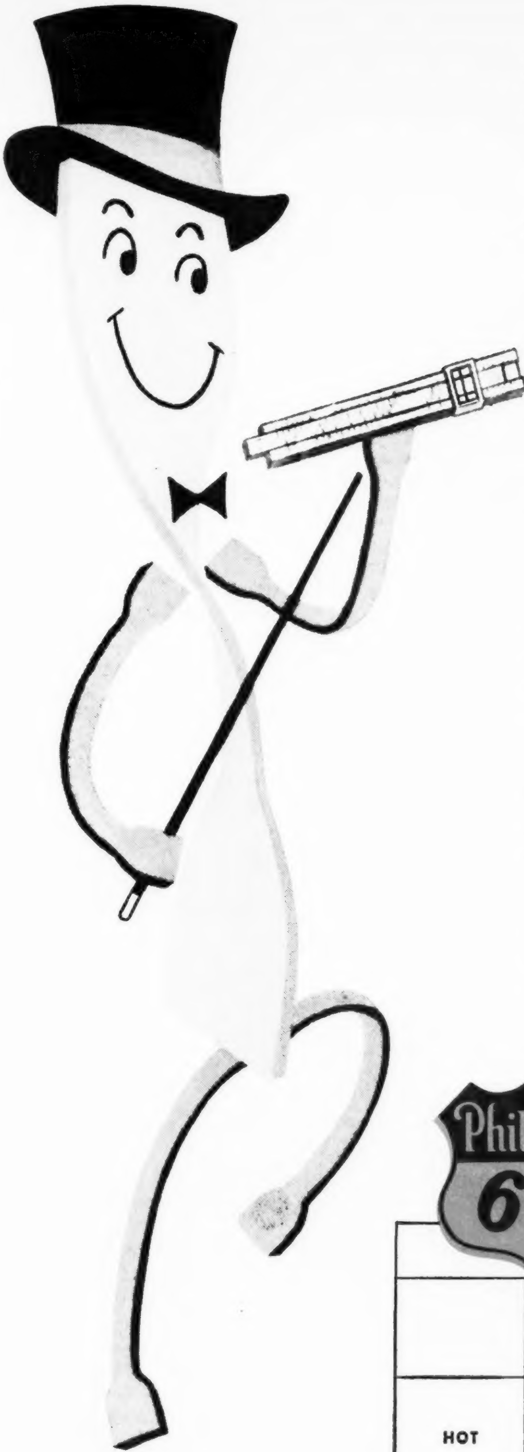
Dolls that cry without squeezing or the use of pacifiers have been placed on the market by Sun Rubber Co., Barberton, O. Called "Sunny Tears," they are designed with what is called "a 100% mechanically perfect" patented device that brings tears to the eyes. The dolls are available in 13- and 18-inch sizes in a variety of models. In addition to crying, the dolls drink, wet, sleep, coo, and have movable arms and legs, the company says.

Two New Dunlop Tires

A new passenger-car tire and a new off-the-road tire have been added to the line of Dunlop Tire & Rubber Corp., Buffalo, N. Y. The first, called Deluxe passenger-car tire, is tubed, with black sidewall, and made of rayon cord construction. Said to be designed to offer quality at the lowest possible initial cost, the tire is available in size 6.70-15, 7.10-15, and 6.00-16.

The off-the-road tire, Super Gold Cup Logger Excavator, is intended primarily for strip mining and logging operations, but is suitable for short hauls on paved roads. This tire is made with nylon cord, strengthened with four nylon breaker strips, and has a tread pattern featuring three deep continuous rolling ribs, notched at intervals to facilitate traction on uneven ground and to throw off impeding objects.

Dunlop Deluxe passenger-car tire *(right)* and Super Gold Cup Logger Excavator tire



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can help you with your rubber problems!

Phillips is an acknowledged leader in synthetic rubber research and has years of experience in this field. It was one of the first companies to create specific polymers to meet the needs of manufacturers of various rubber products.

Phillips maintains a fully-equipped, modern technical service laboratory and a staff of scientists and technicians who are constantly seeking new and better ways to serve their customers.

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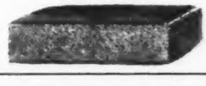
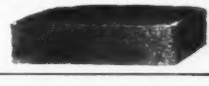
CURRENT PHILPRENE POLYMERS

	NON-PIGMENTED 	PIGMENTED WITH PHILBLACK* 
HOT	PHILPRENE 1000 PHILPRENE 1009 PHILPRENE 1001 PHILPRENE 1010 PHILPRENE 1006 PHILPRENE 1018 PHILPRENE 1019	PHILPRENE 1100 (Pigmented with EPC Black) PHILPRENE 1104
COLD	PHILPRENE 1500 PHILPRENE 1502 PHILPRENE 1503	PHILPRENE 1600 PHILPRENE 1601 PHILPRENE 1605
COLD OIL	PHILPRENE 1703 PHILPRENE 1706 PHILPRENE 1708 PHILPRENE 1712	PHILPRENE 1803

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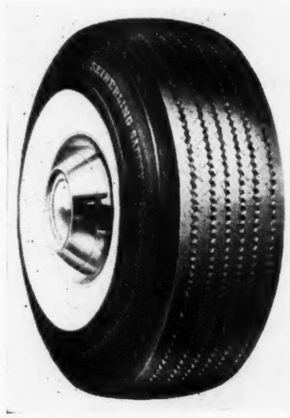
New Seiberling Passenger-Car Tire

A new model of one of its premium passenger-car tires that is said to be strong enough to withstand the shock of a jet airplane landing has been announced by The Seiberling Rubber Co., Akron, O. Called 1957 Safety Tubeless, the white sidewalled 14-inch tire, available in either nylon or rayon cord construction, has so-called silencer blocks designed to improve the tire's road-gripping ability and cut tire squeal. Other features include an increased flexing area in the tire's shoulder region for reducing cord fatigue and vents to dissipate heat build-up.



Seiberling Safety Tubeless

Nine-Pound Bowling Ball

A nine-pound, full-size bowling ball for teen-agers and petite women has been introduced by Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J. The ball is said to have exceptionally high strength for a light ball and is made with the same precision standards as the company's heavier regulation balls.

Correction

A report on the Klauder Williams Foam Master, a machine for making polyurethane foam, erroneously named its manufacturer as Klauder Williams Co. (in our March, 1957, page 946). The actual manufacturer of the equipment is Klauder Weldon Giles Machine Co., Philadelphia, Pa. Gabriel Williams Co., Inc., Brooklyn, N. Y., provides additional sales and service for the machine.

Improved Sectioning Technique

(*Continued from page 392*)

to permit the resolution of the ultimate carbon black particles, as illustrated in Figure 3 and 4.

Summary and Conclusions

A procedure is described for obtaining ultra-thin sections of carbon black-loaded rubber stocks for examination in the electron microscope. The method consists of freezing the sample with carbon dioxide to the desired hardness and cutting sections approximately 0.05-micron thick with a rotary microtome equipped with a special feed. Because no swelling of the rubber occurs when this method is used, the electron micrographs reveal the individual particles of the reinforcing agent exactly as dispersed in the rubber matrix.

The authors are indebted to Cecil E. Hall, of Massachusetts Institute of Technology, for suggesting and guiding this research.

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TECHNICAL BOOKS

BOOK REVIEWS

"Handbook of Solvents—Vol. 1: Pure Hydrocarbons." By Ibert Mellan. Reinhold Publishing Corp., New York, N. Y. Cloth cover, 6¼ by 9¼ inches. 254 pages. Price, $6.50.

This first of a proposed series of handbooks on the properties and composition of industrial solvents is devoted to pure hydrocarbons of all types: aliphatics, aromatics, and terpenes. The author, director of research and production for Pioneer Chemical Co., Inc., has selected from the vast amount of available literatures those materials he considers of greatest practical value. The presentation is organized, compact, and readily accessible. Commercial and proprietary names are used instead of chemical nomenclature. The hydrocarbon solvents are classified in accordance with their distillation range, and a wide spectrum of properties is given in tabular form for each solvent.

"The Chemical Formulary." Volume X. Edited by H. Bennett. Chemical Publishing Co., Inc., New York, N. Y. Cloth cover, 5½ by 8¾ inches, 392 pages. Price, $8.00.

This tenth volume in a series contains several hundred formulae on a wide range of products not previously included in the other volumes. In addition to rubber, resin, and plastics goods, there are recipes and compounding suggestions for adhesives, emulsions and other colloids, ink and marking compounds, leather, lubricants and oils, materials of construction, paint and varnish, paper, polishes, soaps and detergents, and textiles. The 15-page chapter on rubber, resins, plastics, and waxes includes formulae for dispersion coatings, plastic foams, automotive seals, gum erasers, a cheap floor covering, shoe heel compounds, footwear uppers, and shoe soles. In the appendix are pH tables, conversion tables and charts, trade names of chemicals and their suppliers, and other useful information.

NEW PUBLICATIONS

"A Study of Butyl Solvent and Chemical Resistance." Bulletin 102. Thiokol Chemical Corp., Trenton, N. J. 16 pages. Data covering the resistance of butyl rubber to various solvents and chemicals are given in this study, including the volume increase in the rubber when it is immersed in these chemicals, and the influence of fillers, state of cure, cure systems, and plasticizers on resistance.

"Economical Compounding with Hi-Sil at Lowered Price." Hi-Sil Bulletin No. 14. Columbia-Southern Chemical Corp., Pittsburgh, Pa. 13 pages. This is a compounding study outlining the advantages in replacing silicate pigments with Hi-Sil 233 and hard clay combinations. Test data on pigments at equal pound cost in natural rubber, LTP SBR, neoprene, butyl rubber, and nitrile rubber are given in the first half of the study, and a comparison of compounding in typical soling stocks is given in the second half.

"Sulfonate OS." Technical Bulletin 51. Sun Oil Co., Philadelphia, Pa. 2 pages. The company's new anionic surface active agent for the manufacture of oil-soluble rust and corrosion inhibitors and emulsifying, wetting, and dispersing agents is described in this publication.

"Thixon Summary." Bulletin #03-1-6-3-57. Harwick Standard Chemical Co., Akron, O. 2 pages. The currently available Thixon products for the adhesion of rubber and rubber-like materials to metal are summarized in this publication.

"TexUs Synpol." March, 1957. Texas-U. S. Chemical Co., New York, N. Y. 18 pages. Data on the company's styrene-butadiene copolymers are contained in this booklet. Each of its hot and cold types and cold oil-extended types of synthetic rubber is described, and specifications and uses are given for it. Several test recipes are included.

"Plastisolutions to Your Finishing Problems." Stanley Chemical Co., East Berlin, Conn. This folder contains brochures describing the company's chemical coatings, such as vinyls and other synthetics, and technical data sheets detailing manufacturing methods for employing these products.

"Pre-Vulcanized Protective Lining." E. I. du Pont de Nemours & Co., Inc., fabrics division, Fairfield, Conn. 8 pages. The company's Fairprene T-5594 isobutylene sheet stock made specifically for protective lining is described in this illustrated booklet. Its physical properties, chemical resistance, and methods of application are included.

"Hycar Technical Newsletter." Vol. 5. B. F. Goodrich Chemical Co., Cleveland, O. 40 pages. This is the fifth annual edition of the Newsletter. It is a compilation of the information on Hycar published by the company during 1956, in addition to some data completed toward the end of the year and not heretofore published.

"The Rheology of Plastisols." Arnold C. Werner, Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn. 22 pages. This is a reprint of a talk given by Mr. Werner at the Seventh Conference of the Film, Sheeting & Coated Fabrics Division of the Society of the Plastics Industry. The basic principles of rheology are discussed, with specific attention paid to the use of plastisols in high shear applications.

"Weather-Protected Motors." Bulletin 51B8606A. Allis-Chalmers Mfg. Co., Milwaukee, Wis. 6 pages. The company's weather-protected motors, Type FOD in ratings from 250 to 900 hp., for use in the chemical, petroleum, and other industries, are described in this illustrated folder.

"The Tileze XX System." U. S. Sanitary Specialties Corp., Chicago, Ill. 4 pages. The company's spray-on, wipe-up method of cleaning and maintaining all types of flooring, including rubber and vinyl, is summarized in this floor maintenance guide chart.

"Consulting Services." Sixteenth Edition. Association of Consulting Chemists & Chemical Engineers, Inc., New York, N. Y. 136 pages. Price, $1. This latest edition of the Association's guide to its members' activities has sections facilitating the finding of the right chemist and chemical engineer for specific phases of manufacturing, process improvements, research and development, plant designs, and analytical and testing work.

"Buyers' Specification—Latex Foam." The Rubber Manufacturers Association, Inc., New York, N. Y. 6 pages. RMA specifications and test methods for latex foam are reported in this publication. Test methods include sampling, measurement of finished products, indentation or compression load test, accelerated aging, compression set under constant deflection, flexing, and static fatigue.

"Heat Treatment of Enjay Butyl." Enjay Co., Inc., New York, N. Y. 16 pages. The use of Elastopar (N-methyl-N, 4-dinitrosoaniline) as a promoter for butyl rubber to produce heat treatment in normal mixing cycles and at normal mixing temperatures (275-325° F.) is the subject of this insertion for the Enjay Butyl Manual. The effect on vulcanizate properties of Elastopar concentration, mixing techniques, and temperatures is discussed.

"Locked in the Versene claw"—that's the fate of metal ions when they encounter chelation. They become trapped within the inner ring structure of a newly formed compound where they remain unless reverse action is desired. This phrase is taking on new meaning for the rubber industry as the chemistry of chelation is reviewed.

The Chemistry of Chelation: Part IV

Applications in the rubber industry · Prolonging polymerization Inhibiting action · In latexes · Rubber-coated fabrics · A new kind of chemistry?

As has been discussed previously, the Versene® series and Versenol® series chelating agents will inactivate practically all metal ions they contact in solution. The pH factor of the solution or of the finished product influences the choice of agent. To control iron in caustic solutions, look to Versene T®; in alkaline solutions—Versene Fe-3 Specific®; in acid—the Versene series. Or if solutions drift from one pH value to another, an effective Versene combination can be devised to completely complex metal ions present. However, when it is desirable, the claw-like holding power of chelation can be reversed. In polymerization reactions, for example, ferrous iron ions may be released gradually at a predetermined rate. This property is utilized in manufacturing synthetic rubber.

PROLONGING POLYMERIZATION

Erratic polymerization has been a costly bottleneck in the production of synthetic rubber. In the past, reactions would die out before desired conversion took place. Uniform viscosity of the polymer was difficult to maintain. Production delays and poor product uniformity frequently resulted. To correct these problems, pyrophosphates and hydroperoxides proved a step in the right direction . . . but still fell short of being satisfactory. Further study revealed that the final answer lay in organic chelating agents . . . that a reproducible Redox catalyst activation system can be obtained using Versene Fe-3 alone or with pyrophosphate.

A blend of ethylenediaminetetraacetic acid tetra sodium salt and N,N′-di-(2-hydroxyethyl) glycene sodium salt —Versene Fe-3 has proved adequate at less than 1/100 of a part per 100 parts of monomer charged. The complexing action of Versene Fe-3 locks large reservoirs of ferrous ions in solution and releases them gradually, allowing polymerization to continue at a controlled rate. Results: Production delays are reduced to a minimum; plant operations smooth out; product non-uniformities practically disappear.

INHIBITING ACTION

Research has shown chelation to be helpful in other areas of rubber manufacture—notably where copper and manganese cause an embrittlement problem. High costs and discoloring characteristics have been the drawbacks of commonly used inhibitors. But with Versene as the inhibitor, excellent results have been obtained. Versene holds the copper and manganese ions inactive and prevents discoloration from occurring.

IN LATEXES

In latexes, the use of Versene products as stabilizers prevents decomposition, coagulation, sludge formation, and putrefaction where such conditions are caused by metal ion contaminations. Inhibiting action lasts until the latex is coagulated or used for dipping. And if sludge is already precipitated, the Versene resuspends it by complexing the divalent metal compounds that caused the sludge in the first place.

It should be mentioned that wherever proteins, fats, and soaps are present—and metal contamination introduces a problem—chelation may be the answer. In many cases, Versene or Versenol alone is sufficient. But if iron is present along with other divalent metals, or iron alone presents the major problem, the use of Versene Fe-3 Specific or combinations of Versene Fe-3 Specific with Versene or Versenol may be practical.

RUBBER-COATED FABRICS

Difficulties arising in rubberizing fabrics are almost invariably due to traces of copper or manganese in the cloth. Enough contamination to cause trouble can result from passing the cloth over brass guide bars or by using equipment made of copper-bearing alloys.

Such cloth can be decontaminated by rinsing with a hot, dilute Versene solution.

A NEW KIND OF CHEMISTRY?

Is chelation the answer to all ion contamination difficulties? Despite its many successful applications, the answer is sometimes "no". For, remarkable as it is—in locking up metal ions to improve production and product quality—chelation does not solve all problems in every application. But wherever metal ions do pose a problem, investigation is worthwhile. And we'll help in every possible way. To see if you can put the Versene or Versenol products to profitable use, write Technical Service and Development, Dept. SC911N-2, THE DOW CHEMICAL COMPANY, Midland, Michigan.

YOU CAN DEPEND ON DOW

Publications of The Goodyear Tire & Rubber Co., Inc., chemical division, Akron, O.:

"Compounding Study: Mineral Fillers in Chemigum." Tech-Book Facts Compounding Bulletin 56-319. 16 pages. The influence on the company's Chemigum N-7 of Hi-Sil 233, ELC magnesium oxide, magnesium carbonate, and Kaolloid Clay mineral fillers is reported on in this study. Both sulfur-Altax and Altax-Tuads cure systems were tested.

"Compounding Study: Accelerator Systems." Tech-Book Facts Compounding Bulletin 56-320. 6 pages. How diethylene glycol acts in the manner of a secondary accelerator on Plioflex, when used in a shoe sole formulation with Silene EF loading, is the subject of this technical report. Results show that no additional secondary accelerator is required when diethylene glycol is used with Altax or Santocure.

"ASTM Test Methods Employed in Meeting Specifications with Suggested Tech-Book Facts Formulations." Test Procedures Bulletin 57-18. 2 pages. Tests listed here include uncured stock tests, general basic cured tests, accelerated aging, fluid immersion, and low-temperature performance, as well as a number of tests which do not conform to ASTM specifications.

"Standard Test Procedures for Plioflex." Tech-Book Facts Test Procedures Bulletin 56-338. 8 pages. Details for determining volatile matter, stabilizer, soap, bound styrene in SBR, ash content, scorch time, organic acid, and Mooney viscosity are given in this publication.

"Standard Test Procedures for Chemigum." Test Procedures Bulletin 56-339. 4 pages. Discussed in the Tech-Book Fact bulletin are such test procedures for Chemigum as solubility in MEK, water absorption, Mooney plasticity, mill determination of volatile matter and moisture, Brookfield viscosity, and volume swell.

"Standard Test Procedures for Pliolite Reinforcing Resins." Tech-Book Facts Test Procedures Bulletin 57-15. 2 pages. Procedures for determining the heat transformation temperature and moisture content are given here.

"Standard Test Procedures for Wing-Stay S." Test Procedures Bulletin 57-16. 2 pages. Three tests for the company's Wing-Stay S are discussed in this Tech-Book insertion: Stormer viscosity, specific gravity, and refractive index.

"Standard Test Procedures for Wing-Stop B." Tech-Book Facts Test Procedures Bulletin 57-17. 4 pages. Tests outlined here are for total alkalinity, reduction number and reducing power, purity, specific gravity by Westphal balance, and total solids content.

"Index to Tech-Book Facts." April 1, 1957. This is the most recent index to technical literature about Goodyear rubbers and rubber chemicals.

"Compounding Study: White Pigments in Plioflex 1502." Tech-Book Facts Compounding Bulletin 57-45. 4 pages. This is a report of a study undertaken to evaluate the relative merits of white pigments in cold polymerized styrene-butadiene copolymer Plioflex 1502. Fillers used were Hi-Sil 233, Silene EF, Calcene, and hard clay.

"Recommendations for Meeting Spec. MIL-G-432A." Tech-Book Facts Formulations Bulletin 56-313. 4 pages. Recipes and test data for Chemigum gaskets Type I, II, III, VI, and VII are offered in this publication, which replaces Bulletin 56-40.

"Chemigum Roll Compounds." Tech-Book Facts Formulations Bulletin 56-322. 4 pages. Given on these sheets are seven black Chemigum roll recipes and eight neutral Chemigum roll recipes, as well as pre- and post-cure test data.

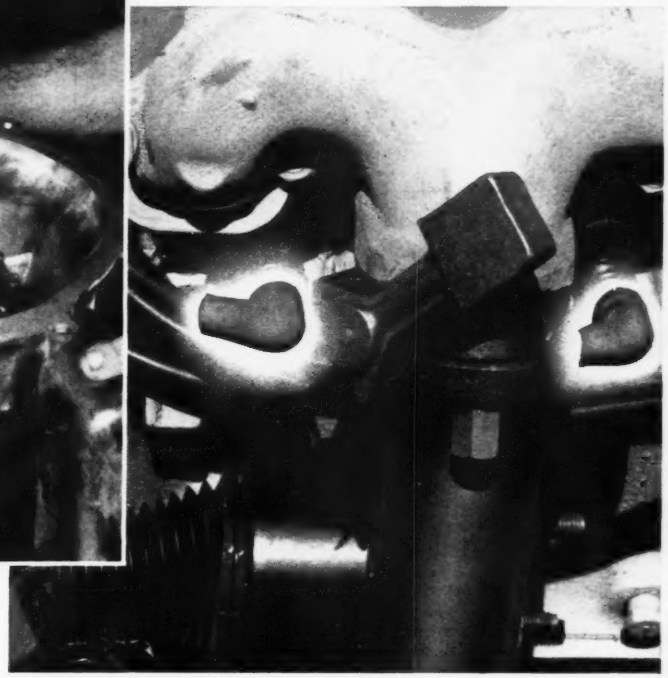
"Recommendations for Meeting Specification AMS-3201-E." Tech-Book Facts Formulations Bulletin 57-44. 2 pages. Two Chemigum recipes for packings and seals and their physical properties are included in this bulletin, which supersedes 56-86.

"Recommendations for Meeting Specification AMS-3227-C." Tech-Book Facts Formulations Bulletin 57-67 (replaces 56-75). 2 pages. This specification covers compounds used to make coolant line hose, packings, bushings, grommets, and seals, for which one Chemigum recipe is given.

"Recommendations for Meeting Specification AMS-3200-C." Tech-Book Facts Formulations Bulletin 57-68. 2 pages. This specification covers compounds used to make seals, gaskets, and similar parts which come in contact with petroleum-base hydraulic fluids, for which one Chemigum recipe is shown.

"Pliolite S-6 Rubber Reinforcing Resin." Types and Properties Bulletin 57-22. 4 pages. The properties of Pliolite S-6 and its effect on rubber stocks are the subject of this Tech-Book Facts insertion.

Automotive transmission seals and spark plug covers withstand heat and provide long lasting resistance to hot oils and moisture when molded from stocks compounded with Silastic 432 Base.



SILASTIC 432 Base

speeds processing of stocks for molded parts

You can compound stocks with *superior physical properties* easier and faster with Silastic* 432 Base than with any silicone rubber gum. This unique Dow Corning compounding base needs no toxic additives for low compression set, requires no bin aging after compounding and has excellent shelf life. Most important, parts molded from stocks compounded with 432 Base show remarkable resistance to heat, cold, moisture and certain hot oils.

TYPICAL PROPERTIES OF MOLDED PARTS MADE WITH SILASTIC 432 BASE

Temperature range, F.	—100 to +500
Tensile strength, psi	800
Elongation, %	260
Tear strength, ppi	70
Compression set, %	25
Hardness, Durometer	50

All properties obtained on ASTM slabs molded 5 minutes at 260 F and cured 8 hours at 480 F.

Do you want the recipe? Complete instructions on the compounding of stocks for better molded parts using Silastic 432 Base plus other custom formulations are obtainable at any Dow Corning branch office. Just ask . . . no obligation.

FREE SAMPLE *Try Silastic 432 Base in your own plant. Write Today. Address Dept. 9418*

*T. M. REG. U. S. PAT. OFF.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

"Silastic Facts." Dow Corning Corp., Midland, Mich:

"Dow Corning A-4000 Adhesive." Reference 4-613. 2 pages. Properties, techniques of use, curing, and performance of this room temperature-curing silicone adhesive for bonding Silastic to itself, to silicone resin laminates, or to metals are contained in this publication.

"Calendering Silastic." Reference 9-219. 2 pages. Methods and equipment for calendering Silastic stock are discussed here.

"Milling, Blending, and Coloring Silastic." Reference 9-220. 2 pages. Methods of milling, coloring, or blending Silastic, as well as the equipment suitable for all three operations, are detailed in this issue of "Silastic Facts."

"Silastic LS-53." Reference 9-372. 2 pages. The postcure test data and chemical resistance of this fluorosilicone rubber, exceptionally resistant to swelling in solvents, jet fuels, and oils, are published on this data sheet.

"Silastic 916." Reference 9-373. 1 page. The physical properties of this silicone rubber, said to be the first that combines high strength with the thermal stability characteristic of silicone rubber, are given here.

Publications of Office of Technical Services, United States Department of Commerce, Washington, D. C.:

"Devices for Damping Mechanical Vibrations, a Bibliography." M. Benton. PB 121299. 101 pages. Price, $2.75. This is a bibliography of the literature on damping devices for mechanical vibrations, published between 1924 and August, 1956. References cover studies of vibration damping by increasing mechanical impedance of the system, by energy dissipation, or by tuned attachments, and of vibration isolation by vibration dampers, connection damping, and material damping.

"Radiological Health Handbook." PB 121784. 356 pages. Price, $3.75. This is a radiological health handbook produced for use in training courses at the U. S. Public Health Service's Robert A. Taft Sanitary Engineering Center in Cincinnati. Included are a glossary of radiological terms and sections on physical, chemical, and mathematical data, radioisotopes, decay, radio assay, and radiation protection.

"An Engineering Study to Determine the Feasibility of Using Butyl Synthetic Elastomer in Mechanical Rubber Items." PB 121426. 33 pages. Price, $1. Butyl synthetic elastomer was shown to have excellent heat aging properties and adequate low-temperature brittleness and ozone resistance during tests of the rubber in mechanical goods, conducted by D. A. Meyer and J. G. Sommer, The Dayton Rubber Co., for the Army's Detroit Arsenal. High levels of plasticizers were necessary to meet low brittleness requirements, and a number of plasticizers were studied. The outstanding plasticizer retention properties of vulcanizates containing Monoplex DOS were demonstrated. Antiozonants and wax were evaluated, and an antiozonant was selected which greatly enhanced ozone resistance.

"The Investigation of the Preparation of Acrylon Rubber Modifications Utilizing Copolymer and Terpolymer Systems." PB 121441. 83 pages. Price, $2.25. This work by B. D. Halpern and W. Karo, The Borden Co., was undertaken for Wright Air Development Center to improve acrylate-acrylonitrile rubber formulations with good heat stability and fuel resistance. Modifications were investigated with trifluoroethyl acrylate used as the major component. Copolymerization of acrylamides with trifluoroethyl acrylate gave elastomers with a number of favorable properties but with high brittle points. Attempts to improve the brittle points resulted in polymers with lower heat stability and higher volume swell. Trifluoroethyl acrylate-acrylonitrile copolymers were also studied.

"Chemical Materials Introduced in 1956." 16 pages. Price, $1. *Chemical Processing,* Chicago, Ill. This reprint from the April issue of this publication lists and describes more than 625 chemical compounds and products introduced by 137 chemical manufacturers during 1956. Composition and uses of the materials are given, as well as names and addresses of manufacturers. An index catagorizes the products into 75 groups, including rubber and plastics.

"Non-Contact Measurement of Hot Dimensions." Industrial Gauges Corp., West Englewood, N. J. 4 pages. The company's infra-ray rod diameter gage for non-contact control and measurement of hot rod diameters for wire rod and other hot rolled shapes is described in this illustrated folder.

Publications of E. I. du Pont de Nemours & Co., Inc., elastomer chemicals department, Wilmington, Del.:

"NA-33: A Delayed-Action Accelerator for the W Types of Neoprene." R. A. Murray. Report No. 57-6. 16 pages. Sample recipes incorporating NA-33, which is said to provide a hitherto unobtainable balance between processing safety and cure rate, are given here, together with test data on the compounds.

"High-Speed Curing of Neoprene Extrusions." C. E. McCormack and J. Becker. Report BL-321. 5 pages. This report describes the processing method for high-speed curing of neoprene extrusions through the surface coating of pellets of neoprene compounds with fast-acting accelerators. The technique is said to eliminate most of the critical processing heat and thus permit very fast cures with freedom from scorch.

"Copper Inhibitor 65." A. L. Moran and L. J. Kowalski. Report BL-322. 4 pages. The properties and effects of this inhibitor of the catalytic action of copper on the oxidation of elastomers are described. Studies are made on natural rubber and neoprene compounds containing copper stearate.

"Combinations of Carbon Blacks for Smooth Neoprene Type W Extrusions." H. Horn and R. M. Murray. Report BL-323. 3 pages. This report describes how small amounts of FEF carbon black in combination with moderate amounts of MT carbon black are used to produce Neoprene Type W compounds that extrude smoothly, have low die swell, and good vulcanizate properties.

"Elastomers Notebook." Issue No. 75. 8 pages. This issue of the Notebook contains articles on Dayton Rubber Co.'s simulated service test for automobile radiator hose, Hypalon hose, neoprene maintenance coating in a utility power plant, a urethane foam-filled cold storage door, and neoprene protective clothing.

Publications of B. F. Goodrich Industrial Products Co., Akron, O.:

"Steam Hose." Bulletin 4500. 2 pages. Specifications, composition, and uses for the company's steam hose are included in this illustrated data sheet.

"Water Suction Hose." Bulletin 4600. 4 pages. Operating data and specifications on five types of water suction hose for industrial use, as well as coupling data, are contained in this illustrated publication.

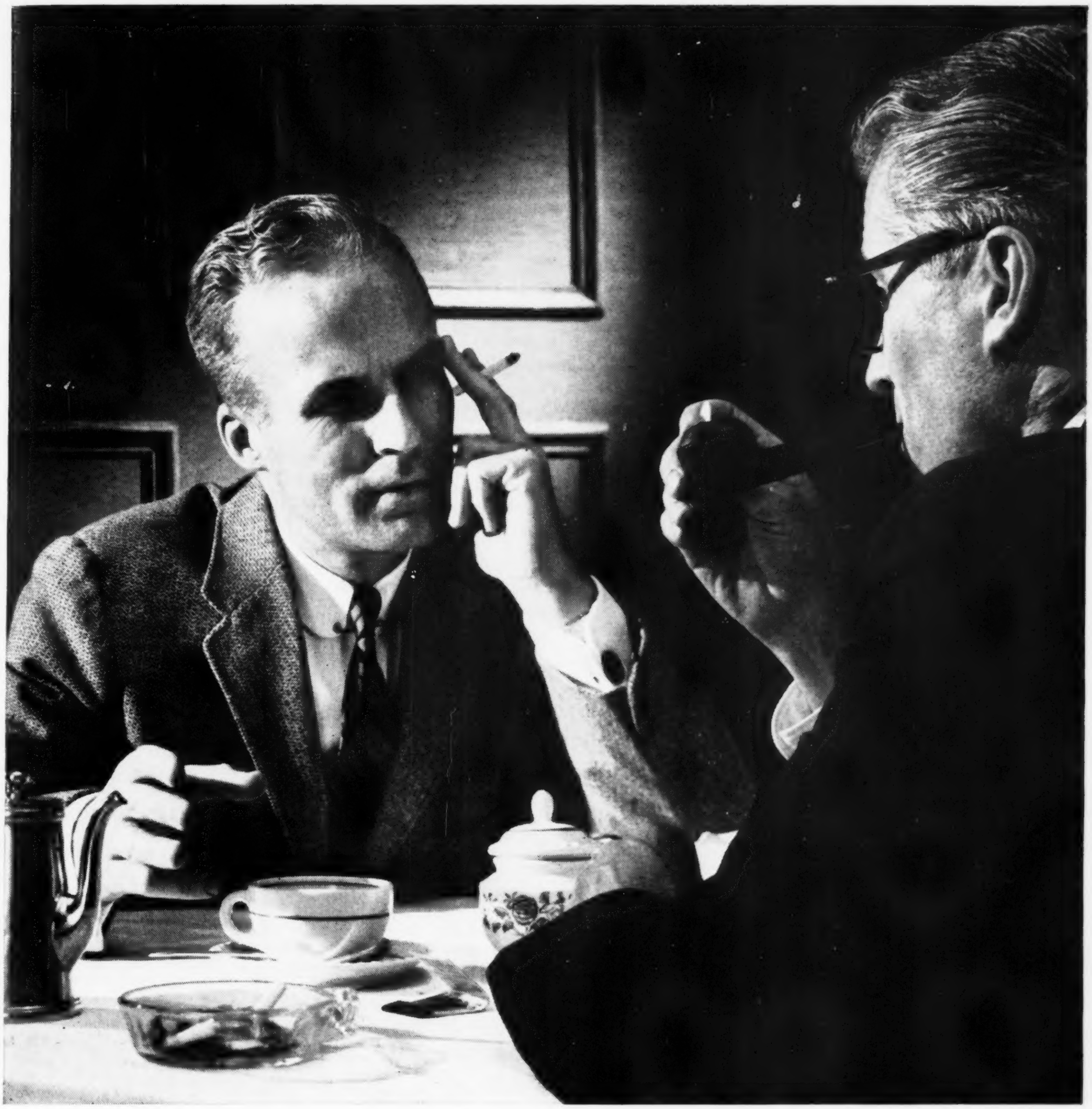
"Emersol Stearic Acids." EM-952. Emery Industries, Inc., Dept. 5, Cincinnati, O. 24 pages. Designed to aid in the selection of the proper grade of the company's stearic acids, this illustrated brochure gives the specifications, typical composition, physical properties, and uses, as well as related test data, on these products.

"Polyethylene Processing Tips." U. S. Industrial Chemicals Co., New York, N. Y. 9 pages. This illustrated file folder contains information on the selection of polyethylene resins for such applications as molding, extruding, electrical, film, coating, and specialty uses.

"Manual of Laboratory Safety." Bulletin FS-201 Fisher Scientific Co., Pittsburgh, Pa. 54 pages. Information on accident prevention, first aid, fire prevention, and safety equipment is contained in this latest edition of the company's illustrated laboratory safety manual. Included is a section on the handling of radioactive materials.

"1957 Year Book." The Tire & Rim Association, Inc., Akron, O. The Association's tire and rim standards, permissible practices, and associate information are given in this latest edition of its Year Book, consisting of separate passenger car, truck-bus, off-the-road, agricultural, industrial, valve, and airplane tabbed sections.

"Standard Samples and Reference Standards." NBS Circular 552 (Second Edition). Superintendent of Documents, Government Printing Office, Washington, D. C. 24 pages. Price, 25¢. The publication contains the latest descriptive listing of the various Standard Samples issued by the National Bureau of Standards and gives a schedule of weights and fees.



MARKET REVIEWS

Synthetic Rubber

Production and consumption of synthetic rubbers during April were down from March levels, according to The Rubber Manufacturers' Association, Inc. Production of synthetic rubbers in U. S. plants was 82,368 long tons in April, compared with March production of 93,916 long tons. April SBR output was 65,151 long tons; March, 76,177 long tons.

Consumption of all types of synthetic rubbers for April amounted to 75,984 long tons. Synthetic rubber consumption had been 82,661 long tons in March. Of the April consumption, 63,123 long tons were SBR, a good-size drop from the 68,824 long tons consumed the month before.

April SBR exports, however, were up to 11,500 long tons from the 10,900 long tons sent abroad in March.

It is generally recognized that there had been a conscious overproduction and overconsumption of synthetic rubbers during the first quarter of the year in an effort to build up product inventories as one defense against threatening strikes. Since only minor labor difficulties developed, production and consumption of synthetic rubbers were cut so as not to build inventories to too high a level. Added to this condition was the disappointing early-spring automotive sales.

Synthetic rubber consumption in May is expected to be about the same as in April. After that the traditional accelerated summer decline will set in until late August.

Early estimates of 1957 new rubber consumption at 1.5 million long tons have now been revised. One usually reliable source put the new figure at 1,490,000 long tons.

Trade sources indicate that General Motors will introduce several new features into its 1957 line before the end of the year in an effort to bolster sales.

Natural Rubber

Quiet, featureless conditions characterized the natural rubber market during the April 16-May 15 period. Only 16,170 tons of rubber were traded on the New York Commodity Exchange, even less than the 20,000 tons traded during the previous period. Sellers' prices in New York were remarkably steady, registering less than a 1¢-a-pound high-low price differential.

One cause of the continued lull in the market was seen to be the lag in automotive sales. According to one press report, 549,239 passenger cars were produced in April, against 578,570 in March, and it is to be assumed that the usual spring upswing in sales will not occur this year. Sales for the year are not expected to be above the 1956 level of 5.9 million units, against an earlier estimate of 6.5 million units. The relative peacefulness of international affairs, including the Suez Canal issue, is probably another reason for the absence of stimulus to rubber buying, since current stocks are believed to be sound.

Statistically, on the New York Commodity Exchange, only 60 of the 16,170 tons traded were on the Rubber-Standard Contract. During April, 16,210 tons were traded on the Rex Contract. There were 21 trading days during the April 16-May 15 period.

Week-end closing Commodity Exchange future prices for the Rex Contract were as follows:

REX CONTRACT

	Mar. 22	Apr. 19	Apr. 26	May 3	May 10
Mar.	32.70	....	....	....	....
May	32.85	32.25	32.50	31.80	31.75
July	32.55	32.25	32.27	31.65	31.51
Sept.	32.25	31.95	31.95	31.35	31.22
Nov.	32.05	31.65	31.75	31.15	31.00
1958					
Jan.	31.85	31.45	31.55	30.85	30.80
Mar.	31.65	31.25	31.35	30.60	30.60
May	....	31.05	31.15	30.35	30.40
Total weekly sales, tons	5,550	1,640	3,300	6,090	3,240

On the physical market, RSS #1 began the period at 32.13¢ a pound, according to the Rubber Trade Association, went to a period-low of 31.63¢ on May 6, and ended the period at 32.25¢ a pound. The grade averaged 32.24¢ for the period, 32.26¢ for the month of April, and 32.19¢ for the first half of May, a clear indication of the steadiness of the market. Other average April spot prices for representative grades were as follows: RSS #3, 31.76¢, #3 Amber Blankets, 28.11¢; and Flat Bark, 21.91¢.

NEW YORK PHYSICAL MARKET
WEEK-END CLOSING PRICES

	Mar. 22	Apr. 19	Apr. 26	May 3	May 10
RSS: #1	33.13	32.38	32.75	32.25	31.88
2	32.88	32.13	32.50	32.00	31.63
3	32.75	31.88	32.25	31.75	31.38
Pale Crepe					
#1 Thick	37.75	36.88	37.13	36.63	36.25
Thin	36.75	35.88	36.13	35.63	35.25
#3 Amber Blankets	29.25	28.00	28.38	28.00	27.88
Thin Brown Crepe	29.00	27.75	28.13	27.75	27.63
Standard Flat Bark	22.50	21.75	22.00	27.50	21.88

Latex

Interest in natural rubber latices, reflecting conditions in the natural rubber market generally, was very light during the April 16-May 15 period. Supplies, extremely sparse during March and April, were therefore easier. The dullness of the market is expected to continue through spring and summer, traditionally the most inactive months of the year.

Reports from the synthetic latex market indicate that demand has also been low. Poor automotive sales are cited as the reason.

Prices for ASTM Centrifuged Concentrated natural latex, in tank-car quantities, f.o.b. rail tank cars, ranged during the period from 39 to 42¢ per pound solids. Prices of synthetic latices were steady at 22 to 32¢ for SBR; 37 to 47¢ for neoprene; and 44 to 54¢ a pound for N types.

Final February and preliminary March domestic statistics for all latices were reported by the United States Department of Commerce as follows:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
Feb.	0	4,342	6,398	9,940
Mar.	0	....	7,487	10,117
SBR				
Feb.	6,481	10	5,894	7,415
Mar.	7,227	....	6,955	7,836
Neoprene				
Feb.	724	0	758	1,169
Mar.	924	0	771	1,029
Nitrile				
Feb.	1,035	0	708	2,051
Mar.	1,127	0	687	1,694

Reclaimed Rubber

Activity in the reclaimed rubber market during the first half of the April 16-May 15 period was at high levels, according to trade sources, but business declined somewhat in early May. The lapse was expected to continue throughout most of May, and total business for the month will be below that of April.

Reclaimed rubber prices were unchanged.

RECLAIMED RUBBER PRICES

Whole tire: first line	$0.11
Fourth line	.0975
Inner tube: black	.16
Red	.21
Butyl	.14
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

Scrap Rubber

There was little activity in the scrap rubber market during the April 16-May 15 period. Synthetic butyl tubes were the object of some interest in both the East and at Akron. In general, reclaimed rubber has been moving so slowly that some


SOX

reclaimers have curtailed operations. Naugatuck, for example, was in operation only four days a week during most of the period.

Despite the lack of volume business, prices of scrap rubber grades at period-end were unchanged.

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$10.00/13.00	$13.50/14.00
S.A.G auto tires	Nom.	Nom.
Truck tires	Nom.	Nom.
Peelings, No. 1	37.00	37.00
2	Nom.	Nom.
3	16.00	17.00
Tire buffing	Nom.	Nom.
	(¢ per Lb.)	
Auto tubes mixed	2.75	2.75
Black	6.50	6.25
Butyl	3.50	3.75
Red	7.00	7.00

Industrial Fabrics

Trading in wide industrial fabrics revived during the last week of the April 16-May 15 period, trade sources reported, with leading mills booking a good volume of business for both spot and near-future delivery.

Plastic coaters entered the market and purchased substantial yardages of wide drills, broken twills, and wide sateens for spot and June delivery. Prices on all fabrics varied, depending upon the mill make and the quantity involved in individual orders.

The current pickup in buying by coaters indicates that stocks have fallen to low levels and replenishment is essential.

Prices of most wide industrial goods have displayed a very soft tone in recent months as a result of the prolonged trading lull in this market. Buying of wide goods has taken place on a hand-to-mouth basis since last fall when a sizable volume of goods was sold ahead.

Period-end prices of industrial fabrics follow:

Industrial Fabrics

Drills		
59-inch 1.85 yd.	yd.	$0.345
2.25-yd.		.295
Ducks		
38-inch 1.78-yd. S.F.	yd.	nom.
2.00-yd. D.F.		.30
51.5-inch, 1.35-yd. S.F.		.4675
Hose and belting		.69
Osnaburgs		
40-inch 2.11-yd.	yd.	.24
3.65-yd.		.1575
Raincoat Fabrics		
Printcloth, 38½-in., 64-60, 5.35-yd.	yd.	.135
6.25-yd.		.1175
Sheeting, 48-inch, 4.17-yd.		.20
52-inch, 3.85-yd.		.23
Chafer Fabrics		
14.40-oz./sq. yd. Pl.	yd.	.73
11.65-oz./sq. yd. S.		.61
10.80-oz/sq. yd. S.		.6575
8.9-oz/sq. yd. S.		.67
Other Fabrics		
Headlining, 59-in., 1.65-yd., 2-ply	yd.	.41
64-inch, 1.25-yd., 2-ply		.59
Sateens, 53-inch, 1.32-yd.		.535
58-inch, 1.21-yd.		.585

Rayon

Total packaged production of rayon and acetate filament yarn during April was 61,800,000 pounds, consisting of 33,300,000 pounds of high-tenacity rayon yarn and 28,500,000 of regular-tenacity yarns. March production had been: total, 63,900,000 pounds; regular-tenacity yarn, 30,200,000 pounds; and high-tenacity rayon yarn, 33,700,000 pounds.

Total filament yarn shipments to domestic consumers came to 57,800,000 pounds, of which 27,300,000 pounds were regular-tenacity yarn and 30,500,000 pounds were high-tenacity rayon yarn. Shipments in March had been: total, 58,100,000 pounds; regular-tenacity yarn, 25,300,000 pounds; and high-tenacity rayon yarn, 32,800,000 pounds.

Total end-of-April stocks were 64,100,000 pounds, made up of 55,600,000 pounds of regular-tenacity yarn and 8,500,000 pounds of high-tenacity rayon yarn. End-of-March stocks had been: total, 62,600,000 pounds; regular-tenacity yarn, 55,000,000 pounds; and high-tenacity rayon yarn, 7,600,000 pounds.

Prices of rayon tire yarns and fabrics in mid-May were unchanged from those of the previous month.

Rayon Prices

Tire Yarns	
High-Tenacity	
1100/480	$0.59/$0.64
1100/490	.59/ .64
1150/490	.64
1165/480	.65
1230/490	.64
1650/720	.55/ .61
1650/980	.55/ .61
1875/980	.61
2200/960	.55/ .60
2200/980	.55/ .60
2200/1466	.64
4400/2934	.60
Super-High-Tenacity	
1650/720	.58
1900/720	.58
Tire Fabrics	
1100/490/2	.77
1650/980/2	.725
2200/980/2	.715

CALENDAR of COMING EVENTS

June 10-August 30
Gordon Research Conferences, Colby Junior College, New London, N. H. (Sessions on Elastomers, July 29-August 2.)

June 16-21
American Society for Testing Materials. Annual Meeting. Atlantic City, N. J.

June 21
Akron Rubber Group. Outing. Firestone Country Club.

June 28
Detroit Rubber & Plastics Group, Inc. Outing. Western Country Club.

July 26
Chicago Rubber Group. Golf Tournament. Medinah Country Club, Medinah, Ill.

August 1
New York Rubber Group. Golf Outing. Baltusrol Golf Club, Springfield, N. J.

August 16
Philadelphia Rubber Group. Golf Outing. Manufacturers' Country Club, Oreland, Pa.

September 7
Connecticut Rubber Group.

September 11-13
Division of Rubber Chemistry, ACS. Hotel Commodore, New York, N. Y.

September 12
Northern California Rubber Group.

September 18-20
National Bureau of Standards, Catholic University of America, Applied Physics Laboratory of Johns Hopkins University. Symposium—"Formation and Stabilization of Free Radicals." National Bureau of Standards, Washington, D. C.

September 23-25
American Society of Mechanical Engineers. Fall Meeting. Hotel Statler, Hartford, Conn.

September 26
Fort Wayne Rubber & Plastics Group.

October 1
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

October 4
New York Rubber Group. Henry Hudson Hotel, New York, N. Y.
Detroit Rubber & Plastics Group, Inc.

October 8
Buffalo Rubber Group.

October 10
Northern California Rubber Group.

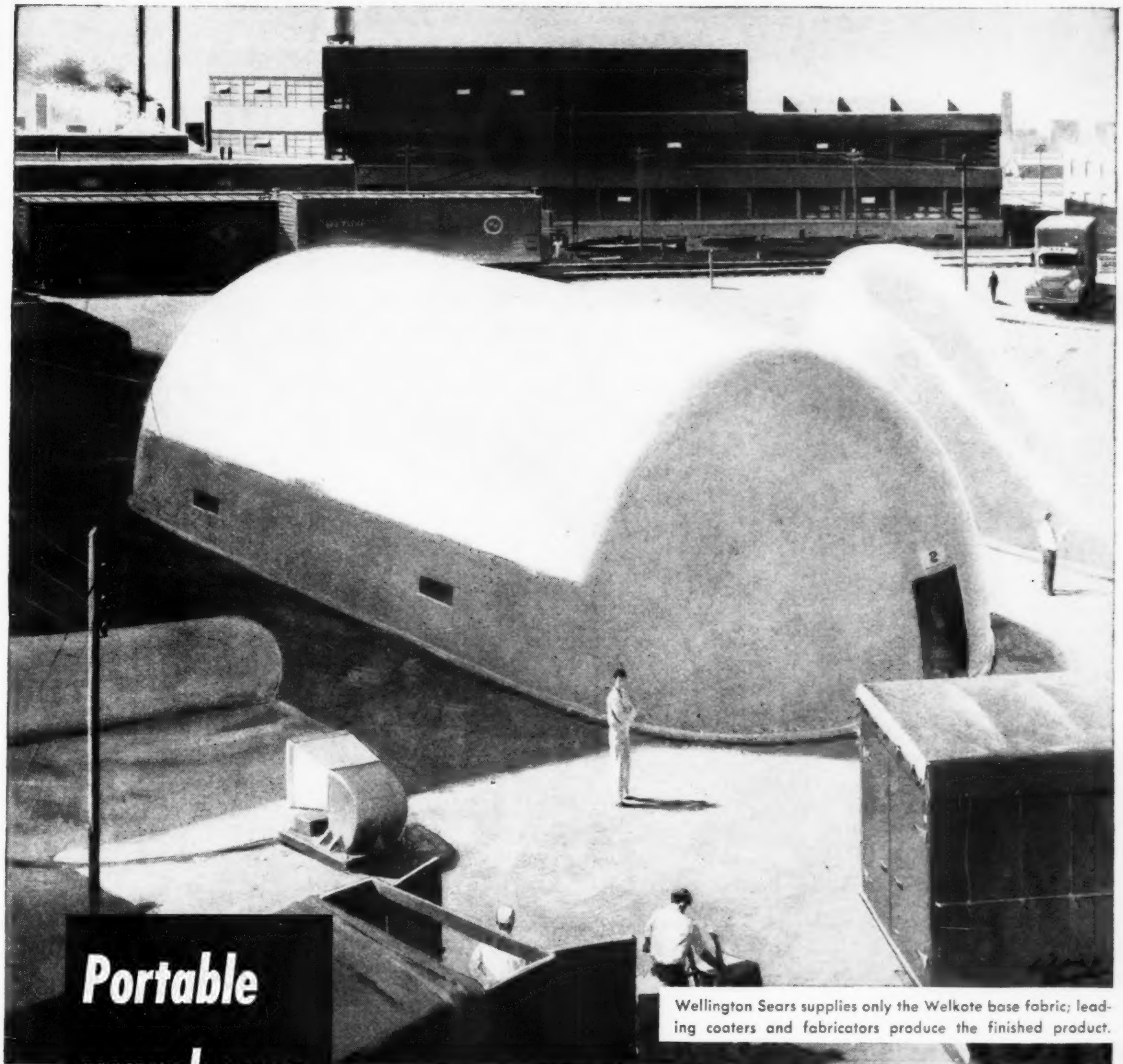
October 11
Chicago Rubber Group. Furniture Club, Chicago, Ill.

October 18
Boston Rubber Group.

October 24
Southern Ohio Rubber Group.

October 25
Akron Rubber
Philadelphia Rubber Group.

November 5
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.



Wellington Sears supplies only the Welkote base fabric; leading coaters and fabricators produce the finished product.

Portable warehouse made of fabric "lives" on air!

No visible means of support: *air* does it! Now huge vinyl-coated nylon buildings can be easily packed, transported swiftly to a site, inflated on the spot, and start receiving goods for storage in a matter of hours. And constant, regulated air pressure keeps walls and roofs taut even when doors are open!

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STATISTICS of the RUBBER INDUSTRY

U.S.A. Imports and Production of Natural (Including Latex and Guayule) and Synthetic Rubber (in Long Tons)

Year	Natural	GR-S	SBR-Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic
1947	688,354	405,496	3,362	62,824	31,495	6,618	1,198,149
1948	735,227	390,240	15,252	56,662	34,848	7,012	1,239,241
1949	660,792	288,882	21,717	54,046	32,215	11,072	1,071,724
1950	802,249	350,801	28,086	60,915	50,067	12,037	1,304,155
1951	733,048	694,583	9,946	76,475	58,907	15,333	1,588,292
1952	805,997	636,969	17,885	81,630	65,745	16,228	1,624,454
1953	647,615	668,386	12,342	79,801	80,495	20,198	1,508,837
1954	596,848	472,698	17,707	58,802	69,150	21,396	1,236,601
1955	635,174	236,556	564,589	56,179	91,357	32,623	1,616,478
1956							
Jan.	58,803	....	76,028	6,896	8,207	3,125	153,059
Feb.	56,497	....	73,457	6,229	8,560	2,989	147,732
Mar.	52,749	....	77,812	5,686	7,822	3,663	147,732
Apr.	51,394	....	74,502	5,685	8,481	3,648	143,710
May	39,789	....	78,309	5,647	7,795	2,903	134,443
June	36,694	....	69,820	4,638	8,929	2,350	122,431
July	41,195	....	70,831	7,192	7,935	2,460	129,613
Aug.	40,367	....	70,122	7,118	7,769	2,141	127,517
Sept.	42,974	....	73,321	7,252	8,328	2,322	134,197
Oct.	52,638	....	70,690	7,018	8,144	2,973	141,463
Nov.	49,757	....	66,482	6,065	8,614	3,092	134,010
Dec.	57,653	....	76,056	6,496	8,828	2,921	151,954
Yr.-end adj.	+1,293	....	......	....	....	....	+1,293
Total	580,510	....	877,430	75,922	99,412	34,567	1,667,841
1957							
Jan.	46,349	....	76,224	6,366	9,432	2,957	141,328
Feb.	37,487	....	66,023	5,664	9,004	2,963	121,141
Mar.*	....	....	76,177	6,417	8,031	3,291	....

* Preliminary.
Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

U.S.A. Consumption of Natural (Including Latex) and Synthetic Rubber (Long Tons)

Year	Natural	GR-S	SBR Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic
1947	562,661	446,316	2,273	68,838	37,703	4,536	1,122,327
1948	627,332	334,233	11,080	58,870	32,118	5,771	1,069,404
1949	574,522	299,420	21,717	52,664	31,753	8,827	988,903
1950	720,268	388,427	27,803	66,348	43,781	11,930	1,258,557
1951	454,015	617,200	9,244	70,500	48,887	13,066	1,212,912
1952	453,846	648,816	17,604	71,229	55,522	13,866	1,260,883
1953	553,473	611,748	12,433	77,826	65,900	16,929	1,338,309
1954	596,285	483,001	17,344	61,464	57,203	17,715	1,233,412
1955	634,800	234,963	507,034	53,991	72,876	26,035	1,529,699
1956							
Jan.	53,751	....	65,375	4,223	6,684	2,198	132,231
Feb.	50,285	....	62,366	4,155	6,430	2,289	125,525
Mar.	50,040	....	64,458	4,515	6,542	2,373	127,928
Apr.	47,446	....	62,179	4,228	6,125	2,150	122,128
May	48,342	....	63,629	4,285	6,379	2,103	124,738
June	43,638	....	56,390	4,026	5,536	1,864	111,454
July	38,353	....	48,907	3,316	4,435	1,538	96,549
Aug.	46,700	....	59,756	4,102	6,554	2,125	119,237
Sept.	44,179	....	57,135	4,044	6,057	1,969	113,384
Oct.	52,188	....	67,399	4,780	7,478	2,366	134,211
Nov.	42,946	....	58,692	4,093	6,676	2,065	114,472
Dec.	45,220	....	60,742	3,814	5,956	1,893	117,625
Yr.-end adj.	−1,000	....	−3,000	....	....	+1,000	−3,000
Total	562,088	....	724,028	49,581	74,852	25,933	1,436,482
1957							
Jan.	52,631	....	70,978	5,028	7,237	2,247	138,121
Feb.	46,427	....	64,322	4,581	6,235	2,122	123,687
Mar.*	48,696	....	68,824	5,062	6,451	2,324	131,357

* Preliminary.
Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

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Allow nine words for keyed address.		*Letter replies forwarded without charge, but no packages or samples.*

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TECHNICAL SALES OR SERVICE POSITION DESIRED. 16 years experience including compounding, production, development, research, etc., as well as sales and service to rubber and allied industries. Address Box No. 2073, care of RUBBER WORLD.

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WANTED: CHEMIST—PLANT MANAGER. AGRESSIVE ORganization seeks rubber chemist and small plant manager with knowledge of extrusions and latex molding. Greater New York area. Attractive proposition and future for the right man. Address Box No. 2068, care of RUBBER WORLD.

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Think of
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Extruders, Tablet Presses, Injection Molders, Hydraulic Presses, Scrap Cutter, Calenders, Mills, Blenders, Mixers, Ovens, Hydraulic Pumps, Laminating and Molding Equipment. See Us First. JOHNSON MACHINERY CO., 679 Frelinghuysen Ave., Dept. RW, Newark, N. J. BIgelow 8-2500.

COMPLETE RAW MATERIAL MIXING PLANT FOR RUBBER. NEVER USED, IN ORIGINAL CRATES, 24"x60" FARREL RUBBER MILLS TWO-ROLL, gear reducer and drive. Conveyors, premixers, sifters, valves, crushers, scale, blender, screen, dryer, dust collector, cutters. 800-ton BALDWIN HYDRAULIC PRESS: 42"x42" platens; 21" str; reblt. '56. 600-ton BALDWIN SOUTHWARK SLAB PRESS: 10 openings; 32"x32"x2"; 24" str. new '47. 500-350-150-Ton metal or plastic down-acting presses; new 1942; 6" and 4½" RUBBER EXTRUDERS, ALLEN, new 1930 approx; very good condition. 12"x30" FARREL 4-ROLL RUBBER CALENDER: 75 HP Gear reducer; good condition. 3—400-T. FARREL HYDR. PRESSES: 48"x48"; 18½" str; steamheated 2500 #PSI; very good condition; 18½" daylight. EVEREADY: BOX 638; BRIDGEPORT, CONNECTICUT: EDison 4-9471, E. J. McCallum, Jr.

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DIVISION OF
SHERMAN RUBBER MACHINERY CO.
BOTWINIK BROTHERS OF MASS., INC.

22 SHERMAN ST. • WORCESTER, MASS.

U.S.A. Stocks of Synthetic Rubber

(Long Tons)

Year	SBR-Types	Butyl	Neoprene	N-Type	Total
1949	77,743	12,224	4,654	3,433	98,054
1950	36,942	7,243	5,733	2,840	52,758
1951	105,271	12,481	8,379	3,821	129,952
1952	83,861	22,716	8,535	3,875	118,987
1953	135,153	24,866	11,480	4,346	175,845
1954	115,499	19,267	11,349	4,280	150,395
1955	108,989	10,500	12,220	6,030	137,739
1956					
Jan.	111,263	12,303	11,850	6,316	141,732
Feb.	114,389	13,027	11,888	6,602	145,906
Mar.	118,063	13,458	12,037	7,437	150,995
Apr.	121,054	14,071	12,042	8,243	155,370
May	127,163	15,253	11,478	8,788	162,682
June	133,570	15,744	12,927	8,955	171,196
July	145,601	18,899	15,084	9,229	188,813
Aug.	148,176	21,267	14,540	8,503	192,486
Sept.	154,841	23,862	14,055	8,035	200,793
Oct.	151,646	25,734	12,841	7,567	197,788
Nov.	151,143	26,998	13,459	7,734	199,334
Dec.	151,934	28,685	14,043	7,934	202,596
Yr.-end. adj.	......	......	......	+250	+250
	151,934	28,685	14,043	8,184	202,846
1957					
Jan.	143,177	29,810	13,073	7,664	193,724
Feb.	134,587	29,951	12,705	7,565	184,808
Mar.*	131,908	30,970	11,817	7,823	182,518

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
* Preliminary.

U.S.A. Stocks of Latex

(Long Tons, Dry Weight)

Year	Natural	GR-S*	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1949	5,063	....	....	...	..	5,063
1950	4,927	....	....	....		4,927
1951	4,752	3,727	1,245	532	5,504	10,256
1952	6,201	5,040	1,019	902	6,961	13,162
1953	13,532	4,794	1,117	721	6,632	20,164
1954	11,133	5,134	1,087	811	7,032	18,165
1955	13,203	6,980	1,236	1,807	10,023	23,226
1956						
Jan.	16,059	6,522	1,093	1,906	9,521	25,580
Feb.	16,735	7,011	1,162	1,943	10,116	26,851
Mar.	18,309	6,867	1,097	2,340	10,304	28,613
Apr.	21,384	7,415	1,163	2,272	10,850	32,234
May	21,234	7,516	1,218	2,194	10,928	32,162
June	21,033	7,447	1,328	2,086	10,861	31,894
July	19,952	7,288	1,109	2,009	10,406	30,358
Aug.	18,099	6,402	1,076	1,703	9,181	27,280
Sept.	15,403	6,625	1,328	1,523	9,476	24,879
Oct.	12,322	5,703	1,263	1,680	8,646	20,968
Nov.	11,148	6,282	1,233	1,939	9,454	20,602
Dec.	12,262	7,327	1,421	2,017	10,765	23,027
Yr.-end adj.	.....	...	....	+200	+200	+200
	12,262	7,327	1,421	2,217	10,965	23,227
1957						
Jan.	11,831	7,191	1,329	1,936	10,456	22,287
Feb.	9,940	7,415	1,169	2,051	10,635	20,575
Mar.†	10,117	7,836	1,029	1,694	10,559	20,676

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
* Includes SBR-Types.
† Preliminary.

U.S.A. Imports and Production of Natural and Synthetic Latices

(Long Tons, Dry Weight)

Year	Natural	GR-S*	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1949	29,974	21,357	3,651	....	25,008	54,982
1950	54,401	31,339	5,725		37,064	91,465
1951	54,963	32,972	6,866	2,948	42,786	97,749
1952	48,228	42,273	7,598	4,164	54,035	102,263
1953	75,511	48,112	9,026	5,844	62,982	138,493
1954	74,483	48,379	8,214	6,866	63,459	137,942
1955						
Jan.	7,853	6,199	617	708	7,524	15,377
Feb.	6,110	5,634	797	525	6,956	13,066
Mar.	7,611	7,078	854	738	8,670	16,281
Apr.	8,550	5,680	975	972	7,627	16,177
May	8,849	5,337	880	815	7,032	15,881
June	7,736	4,777	905	1,450	7,132	14,868
July	8,702	4,800	641	951	6,392	15,094
Aug.	8,885	4,519	881	1,010	6,410	15,295
Sept.	8,109	5,769	994	1,091	7,854	15,963
Oct.	6,900	6,231	922	883	8,036	14,936
Nov.	7,085	6,933	1,004	781	8,718	15,803
Dec.	6,364	6,407	962	874	8,243	14,607
Total	92,754	69,364	10,432	10,798	90,594	183,348
1956						
Jan.	10,328	6,885	848	919	8,652	18,980
Feb.	7,965	6,943	930	827	8,700	16,665
Mar.	7,800	5,911	782	1,158	7,851	15,651
Apr.	6,995	6,097	969	866	7,922	14,917
May	5,731	4,966	939	614	6,519	12,250
June	5,006	4,776	907	543	6,226	11,232
July	3,522	4,241	444	731	5,416	8,938
Aug.	4,715	4,902	882	684	6,468	11,183
Sept.	2,790	5,723	1,180	938	7,841	10,631
Oct.	5,738	6,122	908	1,183	8,213	13,951
Nov.	4,761	6,053	886	1,175	8,114	12,875
Dec.	6,661	7,143	967	1,012	9,122	15,783
Yr.-end adj.	—294	....	....	....	....	—294
Total	71,718	69,762	10,642	10,650	91,054	162,772
1957						
Jan.	6,460	7,270	905	960	9,135	15,595
Feb.	4,342	6,491	724	1,035	8,250	12,592
Mar.*	....	....	924	1,127	....	....

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
* Includes SBR-Types.
† Preliminary.

U.S.A. New Supply, Consumption, Exports, and Stock of Reclaimed Rubber

(Long Tons)

Year	New Supply	Consumption	Exports	Stocks
1949	224,029	222,679	10,367	28,263
1950	314,008	303,733	11,740	35,708
1951	366,700	346,121	14,722	45,082
1952	274,981	280,002	11,180	30,664
1953	298,336	285,050	11,397	32,319
1954	258,101	249,049	10,232	30,746
1955				
Jan.	25,336	25,322	1,041	29,656
Feb.	25,444	24,333	1,085	30,125
Mar.	29,574	28,674	1,088	30,311
Apr.	26,817	26,609	1,088	30,068
May	27,911	27,652	1,056	29,528
June	30,451	29,157	1,128	29,725
July	24,114	22,563	1,176	29,939
Aug.	25,223	25,790	1,144	27,956
Sept.	26,512	26,340	1,018	27,110
Oct.	28,038	26,597	1,381	27,565
Nov.	29,124	27,229	1,313	28,473
Dec.	28,105	24,515	1,470	31,058
Year.-end adj.	......	—2,000	......	+440
Total	326,649	312,781	13,988	31,498
1956				
Jan.	26,205	25,827	1,382	31,640
Feb.	27,108	25,571	1,115	31,875
Mar.	28,468	26,176	1,163	33,326
Apr.	26,933	23,999	1,179	34,360
May	25,485	23,560	1,297	34,863
June	22,153	20,560	1,264	35,647
July	19,776	18,099	952	35,703
Aug.	21,724	21,498	1,076	35,512
Sept.	22,368	20,242	1,015	36,527
Oct.	26,318	23,946	1,298	37,904
Nov.	20,009	20,832	1,189	36,063
Dec.	20,673	20,737	902	34,969
Year-end. adj.	......	—500	....	......
Total	287,220	270,547	13,832	34,969
1957				
Jan.	25,103	24,053	1,288	34,552
Feb.	21,896	22,773	1,263	32,010
Mar.*	24,999	24,668	....	30,760

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
* Preliminary.

MACHINERY & SUPPLIES FOR SALE (Continued)

2 SETS CALENDER ROLLS, 62" WIDTH, 20"-DIA. ROLLS MAX. opening 3". Controls so full mesh is retained on gears regardless of roll position. Full set spare parts available. HAVEG INDUSTRIES, Attn: Mr. Scott Norris, Plant Manager, 900 Greenbank Rd., Wilmington 8, Delaware.

FOR SALE: 6-36" REFINERS, 19"x24"—14" NECKS (CAN BE converted to mills). 2-36" Crackers, Corrugated Rolls—14" Necks. HEAVY-DUTY, WATER-COOLED BEARINGS, STEEL GEARS—GOOD OPERATING CONDITION, CAN BE INSPECTED UNDER POWER. Address Box No. 2070, care of RUBBER WORLD.

FOR SALE—1 ADAMSON 6-12"—3-ROLL CALENDER; 1—42x42"—8-opening hydraulic press, 26" ram; 1—18x50" 2-roll mill; 1—3¼" insulated wire extruder; also vulcanizers, cutters, mixers, etc. CHEMICAL & PROCESS MACHINERY CORP., 52 Ninth Street, Brooklyn 15, N. Y.

FOR SALE: INJECTION MOLDING MACHINES—LESTER, REED-Prentice, Watson-Stillman, Impco, H.P.M.— 2 oz., 4 oz., 6 oz., 8 oz., 12 oz., 16 oz., 20 oz., 24 oz. EXTRUDERS—NRM, Allen, Davis, Hartig—1½", 2", 2½", 6", 8". Royle #1 and #2. JACKETED MIXERS—2¼ to 100 gal.—Steel and Stainless. PERRY EQUIPMENT CORP., 1424 N. 6th St., Phila. 22, Pa.

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ORIGINAL SHORE

DUROMETER

A-2 SCALE (A.S.T.M. D676)

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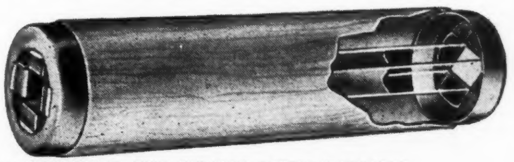

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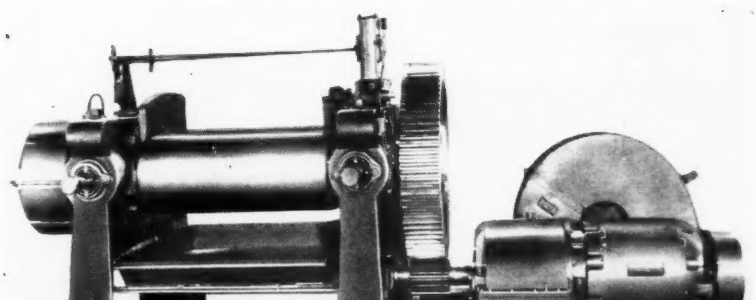

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U.S.A. Exports of Synthetic Rubber

(Long Tons)

Year	SBR-Types	Butyl	Neoprene	N-Type	Total
1954	11,069	2,831	12,062	4,155	30,117
1955	60,704	9,895	18,098	4,593	93,290
1956					
Jan.	7,550	815	1,757	506	10,628
Feb.	9,018	1,624	1,521	449	12,612
Mar.	10,804	764	1,500	522	13,590
Apr.	10,271	374	1,917	587	13,149
May	10,864	743	2,142	443	14,192
June	9,558	746	2,088	548	12,940
July	9,038	523	1,994	433	11,988
Aug.	9,607	654	2,268	274	12,803
Sept.	8,804	439	2,824	403	12,470
Oct.	6,795	454	1,013	618	8,880
Nov.	4,789	247	1,056	551	6,643
Dec.	15,268	1,316	1,829	860	19,273
Total	112,366	8,699	21,909	6,194	149,168
1957					
Jan.	13,989	207	2,500	540	17,236
Feb.	13,353	439	2,505	482	16,779

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

U.S.A. Consumption of Natural and Synthetic Latices

(Long Tons, Dry Weight)

Year	Natural	GR-S*	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1954	75,931	44,173	7,251	4,507	55,931	131,862
1955	86,478	63,982	8,736	8,495	81,213	167,691
1956						
Jan.	6,776	5,858	772	670	7,300	14,076
Feb.	6,399	5,913	787	730	7,430	13,829
Mar.	6,438	5,888	729	781	7,398	13,836
Apr.	5,693	4,923	741	692	6,356	12,049
May	5,239	4,745	778	691	6,214	11,453
June	5,171	4,350	637	657	5,644	10,815
July	4,855	3,731	562	466	4,759	9,614
Aug.	6,374	5,055	816	698	6,569	12,943
Sept.	6,233	4,937	692	699	6,328	12,561
Oct.	7,825	6,175	795	681	7,651	15,476
Nov.	6,431	5,406	723	659	6,788	13,219
Dec.	6,666	5,399	701	710	6,810	13,476
Yr.-end adj.	−1,000	+3,000	....	+800	+3,800	+2,800
Total	73,100	65,380	8,733	8,934	83,047	156,147
1957						
Jan.	6,994	6,288	856	841	7,985	14,979
Feb.	6,398	5,894	758	708	7,360	13,758
Mar.*	7,487	6,955	771	687	8,413	15,900

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
† Preliminary. * Includes SBR-Types.

U.S.A. Rubber Industry Sales and Inventories

(Million of Dollars)

	Value of Sales*				Manufacturers' Inventories*			
	1954	1955	1956	1957	1954	1955	1956	1957
Jan.	348	424	415	474	844	790	935	995
Feb.	351	440	445	476	857	782	970	985
Mar.	388	466	451	...	849	805	979	...
Apr.	375	445	445	.	812	784	970	...
May	357	465	464	.	810	810	985	...
June	377	465	450	...	829	850	975	...
July	374	471	459	...	784	853	987	...
Aug.	337	456	436	...	761	863	1,007	...
Sept.	334	456	429	...	804	874	1,007	...
Oct.	332	447	454	...	838	902	1,022	...
Nov.	388	482	463	...	819	935	1,024	...
Dec.	407	465	461	...	929	934	998	...
Total	4,368	5,493	5,372	...	Av. 831	845	988	...

Source: Office of Business Economics, U. S. Department of Commerce.
* Adjusted for seasonal variation.

U.S.A. Synthetic Rubber Industry, Wages, Hours

Year	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings
1954	$90.76	40.7	$2.23
1955			
Jan.	93.02	40.8	2.28
Feb.	93.07	41.0	2.27
Mar.	94.12	41.1	2.29
Apr.	99.5	42.9	2.32
May	95.22	41.4	2.30
June	96.51	41.6	2.32
July	97.53	41.5	2.35
Aug.	99.96	42.0	2.38
Sept.	100.08	41.7	2.40
Oct.	98.83	41.7	2.37
Nov.	100.14	41.9	2.39
Dec.	100.98	41.9	2.41
1956			
Jan.	101.88	42.1	2.42
Feb.	101.57	41.8	2.43
Mar.	102.51	41.5	2.47
Apr.	102.75	41.6	2.47
May	103.00	41.2	2.50
June	103.41	41.2	2.51
July	103.41	41.5	2.50
Aug.	108.03	42.2	2.56
Sept.	104.90	41.3	2.54
Oct.	107.52	42.0	2.56
Nov.	103.57	41.1	2.52
Dec.	107.33	41.6	2.58
1957			
Jan.	107.07	41.5	2.58

Source: BLS, United States Department of Labor.

Carbon Black Statistics—First Quarter 1957

Furnace blacks are classified as follows: SRF, Semi-reinforcing furnace black; HMF, high modulus furnace black; FEF, fast-extruding furnace black; HAF, high abrasion furnace black; SAF, super abrasion furnace black; ISAF, intermediate super abrasion furnace black.

(Thousands of Pounds)

	Jan.	Feb.	Mar.
Production			
Furnace types			
Thermal	13,200	10,064	12,147
SRF	26,328	21,623	27,167
HMF	11,112	10,898	10,292
FEF	17,125	13,340	20,439
HAF	42.186	34,730	41,201
SAF, ISAF	16,348	15,246	18,864
Total furnace	126,299	105,901	130,110
Contact types	31,563	27,792	30,726
Totals	157,862	133.693	160,836
Shipments			
Furnace types			
Thermal	13,499	11,726	12,442
SRF	25,864	24,246	37,063
HMF	10,517	10,273	13,449
FEF	21,080	17,685	26,129
HAF	38,446	37.049	55,187
SAF, ISAF	15,978	14.692	20,562
Total furnace	125.384	115,671	164,832
Contact types	35,688	32,565	42,196
Totals	161.072	148,236	207,028
Producers' Stocks, End of Period			
Furnace types			
Thermal	18,478	16,816	16,521
SRF	76,472	73,781	63,885
HMF	20,163	20,788	17,631
FEF	29,362	25,006	19,316
HAF	60,018	57.699	43,713
SAF, ISAF	56,740	57,373	55,675
Total furnace	261,233	251,463	216,741
Contact types	73,385	68,612	57,142
Totals	334,618	320,075	273,883
Exports			
Furnace types			
Total furnace	18,605	23,722	...
Contact types	18,306	21,218	
Totals	36,911	44,940	

Source: Bureau of Mines, United States Department of the Interior, Washington, D. C.

World Production of Natural Rubber

(1,000 Long Tons)

Year	Malaya Estate	Malaya Native	Indonesia Estate	Indonesia Native	All Other	Total
1955	352.9	286.2	261.3	472.4	521.2	1,895.0
1956						
Jan.	32.6	26.5	23.5	17.4	42.5	142.5
Feb.	27.6	24.3	23.0	20.9	36.7	132.5
Mar.	28.5	22.5	21.5	16.4	41.1	130.0
Apr.	26.7	21.7	20.0	46.1	40.4	155.0
May	23.5	19.8	18.0	38.4	37.8	137.5
June	29.5	23.2	21.9	25.9	44.5	145.0
July	30.8	23.9	21.3	41.5	45.0	162.5
Aug.	30.3	23.0	20.3	64.0	44.9	182.5
Sept.	30.2	21.9	21.3	29.0	42.6	145.0
Oct.	30.5	22.5	22.0	34.0	53.5	162.5
Nov.	28.4	21.3	21.9	44.4	51.5	167.5
Dec.	34.7	24.2	23.0	49.5	53.6	185.0
Total	353.0	274.4	258.2	428.5	558.4	1,872.5
1957						
Jan.	36.1	27.3	23.8	22.7	45.1	155.0
Feb.	27.1	22.1	20.6	16.4	38.8	125.0

Source: BDSA, United States Department of Commerce; Secretariat of the International Rubber Study Group; and United Baltic Corp., Ltd.

World Production of Synthetic Rubber

(1,000 Long Tons)

Year	U.S.A.	Canada	Germany	Total
1955	970.5	103.9	10.9	1,085.3
1956				
Jan.	93.5	9.7	1.0	104.3
Feb.	90.5	8.2	1.0	99.7
Mar.	94.4	10.3	1.1	105.8
Apr.	91.6	10.3	1.0	102.8
May	93.7	10.6	1.0	105.3
June	85.3	10.4	0.6	96.3
July	88.0	8.7	1.0	97.7
Aug.	86.5	10.2	0.9	97.6
Sept.	90.6	10.7	0.8	102.1
Oct.	88.2	10.7	0.8	99.7
Nov.	83.5	10.3	0.8	94.7
Dec.	93.8	10.6	0.8	105.2
Total	1,079.6	120.7	10.7	1,211.0
1957				
Jan.	94.3	11.1	. . .	. . . .
Feb.	83.2	9.8	. . .	. . . .

Source: Secretariat of the International Rubber Study Group; and BDSA, United States Department of Commerce.

World Consumption of Natural Rubber

(1,000 Long Tons)

Year	United States	U.S.S.R.* and China	United Kingdon	Other Foreign	Total Foreign	Grand* Total
1955	634.8	56.2	246.3	900.2	1,202.7	1,837.5
1956						
Jan.	53.4	14.4	21.7	73.0	109.1	162.5
Feb.	50.1	19.1	17.9	72.9	109.9	160.0
Mar.	49.6	11.7	16.0	73.7	100.4	150.0
Apr.	47.0	14.6	18.4	72.5	105.5	152.5
May	48.3	16.8	14.5	75.4	106.7	155.0
June	43.6	20.8	16.1	82.0	118.9	162.5
July	38.4	16.6	14.7	75.3	106.6	145.0
Aug.	46.7	7.1	10.3	73.4	90.8	137.5
Sept.	44.2	17.1	14.5	81.7	113.3	157.5
Oct.	52.2	15.5	18.8	76.0	110.3	162.5
Nov.	43.0	27.2	15.7	76.6	119.5	162.5
Dec.	45.2	29.9	14.3	73.1	117.3	162.5
Total	563.1	215.0	192.8	914.1	1,321.9	1,885.0
1957						
Jan.	52.6	6.3	14.4	79.2	99.9	152.5
Feb.	46.8	14.5	14.5	81.7	110.7	157.5

Source: BDSA, United States Department of Commerce; Secretariat of the International Rubber Study Group; and United Baltic Corp., Ltd.
* Estimated.

U.S.A. Production of Cotton, Rayon, and Nylon Tire Fabrics

	Cotton and Nylon*: Cotton Chafer Fabrics and Other Tire Fabrics	Cotton and Nylon*: Cotton and Nylon Tire Cord and Fabrics	Rayon Tire Cord: Woven	Rayon Tire Cord: Not Woven	Total All Tire Cord and Fabrics
1955					
Jan.-Mar.	12,763	14,870	79,191	20,299	127,123
Apr.-June	12,728	18,527	80,908	21,550	133,713
July-Sept.	12,941	16,093	81,996	20,740	131,770
Oct.-Dec.	12,333	15,754	77,600	24,343	130,030
Total	50,765	65,244	319,695	86,932	522,636
1956					
Jan.-Mar.	12,815	16,483	74,833	23,707	127,838
Apr.-June	10,322	19,471	61,196	21,557	112,546
July-Sept.	7,958	18,958	56,961	18,698	102,575
Oct.-Dec.	9,497	19,720	55,639	20,071	104,927
Total	40,592	74,632	248,629	84,033	447,886
1957					
Jan.-Mar.	11,028	21,476	68,825	21,853	123,182

*Cotton and nylon figures combined to avoid disclosing data for individual companies.
Source: Bureau of the Census, United States Department of Commerce.

U.S.A. Automotive Inner Tubes

(Thousands of Units)

Year	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1954	25,090	35,442	948	61,480	58,397	9,299
1955	5,002	33,360	999	39,363	35,900	6,833
1956						
Jan.	274	3,263	72	3,608	2,918	6,294
Feb.	273	2,548	100	2,921	2,969	6,547
Mar.	282	2,587	93	2,962	3,347	6,848
Apr.	265	2,444	88	2,797	3,094	7,312
May	280	2,515	83	2,878	3,093	7,657
June	269	3,023	79	3,370	2,837	7,349
July	248	3,055	82	3,384	2,300	6,418
Aug.	242	2,954	99	3,295	2,795	5,962
Sept.	213	2,472	91	2,777	2,774	6,056
Oct.	261	2,514	102	2,877	3,025	6,469
Nov.	259	2,468	65	2,792	2,585	6,250
Dec.	235	2,515	87	2,838	2,670	6,109
Total	3,101	32,358	1,041	36,499	34,407	
1957						
Jan.	274	3,263	72	3,608	2,918	6,294
Feb.	267	2,964	61	3,292	3,362	5,960
Mar.	240	3,057	100	3,397	3,822	6,540

Source: The Rubber Manufacturers Association, Inc.

World Consumption of Synthetic Rubber*

(1,000 Long Tons)

Year	U.S.A.	Canada	United Kingdon	Total† Continent of Europe	World† Grand Total
1955	894.9	40.2	20.5	78.3	1,057.5
1956					
Jan.	78.5	4.0	3.1	9.0	100.0
Feb.	75.2	4.1	3.1	9.0	95.0
Mar.	78.3	4.1	3.1	9.0	97.5
Apr.	73.7	4.4	3.6	8.8	97.5
May	76.4	4.5	3.2	8.5	97.5
June	67.8	4.0	3.6	9.5	90.0
July	58.2	3.7	2.9	8.8	80.0
Aug.	72.5	3.3	2.3	7.5	90.0
Sept.	69.2	3.9	3.2	9.0	90.0
Oct.	82.0	4.2	4.1	10.8	105.0
Nov.	71.5	4.3	3.9	10.5	95.0
Dec.	73.3	3.8	3.6	9.8	97.5
Total	877.3	48.4	39.5	110.5	1,135.0
1957					
Jan.	85.5	4.4	3.7	. .	110.0
Feb.	77.9	4.2	3.9	. .	100.0

Source: Secretariat of the International Rubber Study Group; BDSA, United States Department of Commerce.
* Includes latices.
†Figures estimated or partly estimated.

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U.S.A. Automotive Pneumatic Casings

(Thousands of Units)

	Shipments: Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
Passenger Car						
1954	29,746	47,043	928	77,717	76,806	12,228
1955	42,574	50,156	966	93,698	97,232	15,963
1956						
Jan. ..	2,958	4,040	66	7,064	7,661	16,546
Feb. ..	2,919	3,387	90	6,396	7,571	17,701
Mar. ..	3,027	4,372	65	7,464	7,812	18,096
Apr. ..	2,787	4,994	67	7,847	7,530	17,649
May ..	2,349	5,203	65	7,617	7,628	17,714
June ..	2,162	5,659	64	7,885	6,600	16,443
July ..	2,471	5,482	73	8,026	5,669	14,088
Aug. ..	1,953	5,359	77	7,389	6,897	13,578
Sept. ..	1,262	4,427	70	5,758	6,647	14,468
Oct. ..	2,530	3,854	87	6,471	7,526	15,607
Nov. ..	3,179	3,255	62	6,496	6,580	15,596
Dec. ..	3,277	3,220	90	6,587	7,425	16,494
Total	30,874	42,411	876	85,000	95,546	
1957						
Jan. ..	3,192	4,521	100	7,812	8,296	16,978
Feb. ..	3,017	4,453	68	7,538	8,047	17,376
Mar. ..	3,051	4,875	80	8,006	8,629	18,065
Truck and Bus						
1954	3,592	8,111	826	12,529	12,347	2,546
1955	4,801	9,034	910	14,746	14,957	2,815
1956						
Jan. ..	444	629	65	1,139	1,318	2,971
Feb. ..	424	565	88	1,077	1,326	3,232
Mar. ..	439	662	62	1,163	1,382	3,465
Apr. ..	430	767	74	1,271	1,303	3,483
May ..	421	777	65	1,264	1,358	3,582
June ..	372	968	65	1,404	1,329	3,504
July ..	362	837	73	1,272	1,073	3,306
Aug. ..	349	820	86	1,254	1,154	3,217
Sept. ..	291	811	92	1,194	1,153	3,180
Oct. ..	378	849	78	1,305	1,273	3,168
Nov. ..	337	626	59	1,022	1,060	3,207
Dec. ..	301	583	76	961	1,130	3,378
Total	4,548	8,894	883	14,326	14,589	
1957						
Jan. ..	305	678	83	1,066	1,208	3,512
Feb. ..	344	598	59	1,001	1,122	3,633
Mar. ..	330	704	74	1,107	1,136	3,678
Total Automotive						
1954	33,338	55,154	1,754	90,246	89,153	14,774
1955	47,375	59,191	1,878	108,447	112,178	18,778
1956						
Jan. ..	3,402	4,669	131	8,203	8,979	19,517
Feb. ..	3,343	3,953	178	7,473	8,897	20,934
Mar. ..	3,466	5,034	127	8,627	9,193	21,562
Apr. ..	3,217	5,761	141	9,119	8,834	21,132
May ..	2,770	5,980	130	8,880	8,987	21,296
June ..	2,533	6,627	129	9,289	7,930	19,947
July ..	2,833	6,319	146	9,298	6,741	17,394
Aug. ..	2,303	6,179	163	8,644	8,050	16,795
Sept. ..	1,553	5,238	162	6,952	7,800	17,648
Oct. ..	2,908	4,703	165	7,776	8,799	18,775
Nov. ..	3,516	3,881	121	7,518	7,641	18,803
Dec. ..	3,579	3,803	166	7,548	8,556	19,872
Total	35,423	62,147	1,759	99,327	100,407	
1957						
Jan. ..	3,496	5,199	183	8,878	9,504	20,490
Feb. ..	3,361	5,052	127	8,539	9,169	21,009
Mar. ..	3,381	5,579	154	9,114	9,766	21,743

Source: The Rubber Manufacturers Association, Inc.

Canadian Rubber Consumption By Main Products

(Long Tons)

	1955	First Quarter 1956	Second Quarter 1956	Third Quarter 1956	Fourth Quarter 1956	Total 1956
Tires, tubes	55,824	14,820	15,986	14,260	16,701	61,767
Wire, cable	2,460	834	970	844	1,045	3,693
Footwear	8,148	2,017	2,053	1,806	2,173	8,049
Miscellaneous	18,096	4,506	4,769	3,940	4,734	17,949
Total	84,548	22,177	23,778	20,850	24,653	91,458

Source: Secretariat of the International Rubber Study Group.

U.S.A. Rubber Industry Employment, Wages, Hours

Year	Production Workers (1000's)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings	Consumers Price Index
All Rubber Products					
1939	121	$27.84	39.9	$0.75	.
1954	195	78.21	39.7	1.97	114.8
1955	216.3	87.57	41.7	2.10	114.5
1956					
Jan.	232.5	87.91	40.7	2.16	114.6
Feb.	227.6	85.81	40.1	2.14	114.6
Mar.	224.7	84.93	39.5	2.15	114.7
Apr.	224.6	85.79	39.9	2.15	114.9
May	215.9	86.18	39.9	2.16	115.4
June	211.3	84.93	39.5	2.15	116.2
July	207.3	86.15	39.7	2.17	117.0
Aug.	209.3	87.64	40.2	2.18	116.8
Sept.	216.6	89.51	40.5	2.21	117.1
Oct.	217.7	90.17	40.8	2.21	117.7
Nov.	206.0	88.70	40.5	2.19	117.8
Dec.	217.9	93.15	41.5	2.25	118.0
1957					
Jan.	222.0	92.48	41.1	2.25	118.2
Feb.	221.5	...	...	.	118.7
Tires and Tubes					
1939	54.2	$33.36	35.0	$0.96	
1954	79.7	87.85	38.7	2.27	
1955	90.2	101.09	41.6	2.43	
1956					
Jan.	94.1	101.00	40.4	2.50	
Feb.	93.7	97.71	39.4	2.48	
Mar.	93.3	97.89	39.0	2.51	
Apr.	91.8	98.00	39.2	2.50	
May	91.6	99.00	39.8	2.51	
June	90.1	98.25	39.3	2.50	
July	90.8	98.14	39.1	2.51	
Aug.	89.8	101.20	40.0	2.53	
Sept.	91.6	102.51	40.2	2.55	
Oct.	91.7	102.66	40.1	2.56	
Nov.	74.8	103.53	40.6	2.55	
Dec.	93.2	109.25	41.7	2.62	
1957					
Jan.	93.8	108.94	41.9	2.60	
Rubber Footwear					
1939	14.8	$22.80	37.5	$0.61	
1954	20.7	67.43	39.9	1.69	
1955	18.2	70.70	40.9	1.75	
1956					
Jan.	26.2	74.37	40.2	1.85	
Feb.	26.1	74.74	40.4	1.85	
Mar.	25.8	71.16	39.1	1.82	
Apr.	20.3	72.25	39.7	1.82	
May	20.0	72.25	39.7	1.82	
June	19.4	70.53	39.4	1.79	
July	18.9	71.28	39.6	1.80	
Aug.	19.2	70.35	39.3	1.79	
Sept.	19.3	71.71	39.4	1.82	
Oct.	19.1	71.71	39.4	1.82	
Nov.	18.7	71.55	39.1	1.83	
Dec.	18.4	73.26	39.6	1.85	
1957					
Jan.	18.1	71.94	39.1	1.84	
Other Rubber Products					
1939	51.9	$23.34	38.9	$0.61	
1954	94.3	71.91	40.4	1.78	
1955	107.9	78.35	41.9	1.87	
1956					
Jan.	112.2	79.73	41.1	1.94	
Feb.	107.8	77.95	40.6	1.92	
Mar.	105.6	76.99	40.1	1.92	
Apr.	106.6	77.95	40.6	1.92	
May	104.7	76.40	40.0	1.91	
June	99.0	76.02	39.8	1.91	
July	99.1	77.78	40.3	1.93	
Aug.	101.8	78.76	40.6	1.94	
Sept.	195.2	81.18	41.0	1.98	
Oct.	109.2	82.98	41.7	1.99	
Nov.	105.4	79.98	40.6	1.97	
Dec.	109.9	82.59	41.5	1.99	
1957					
Jan.	110.1	81.60	40.8	2.00	

Source: BLS, United States Department of Labor.

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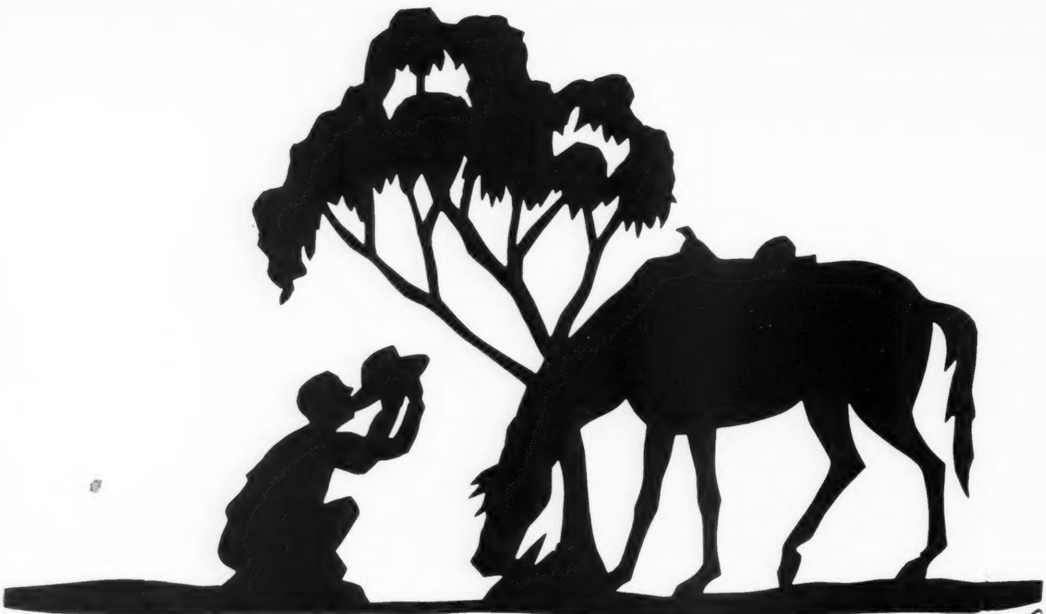

Paul Le Mary

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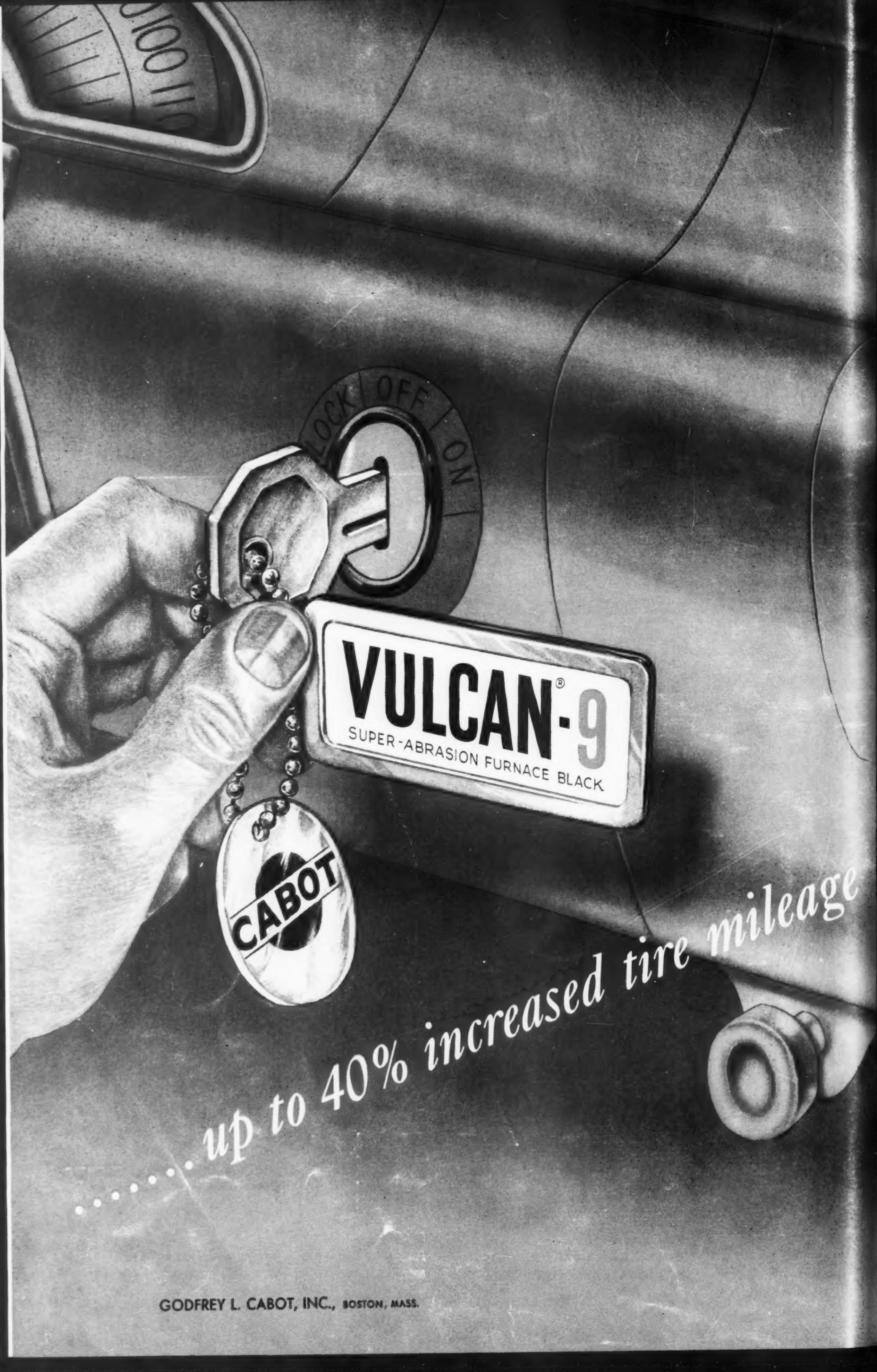

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